U. S. COMMISSION OF FISH AND FISHERIES.
GEORGE M. BOWERS, Commissioner.

PART XXVII.

REPORT

OF

THE COMMISSIONER

FOR

THE YEAR ENDING JUNE 30, 1901.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

SH11
.A15
1901

1136

CONTENTS.

	Page.
Report of the Commissioner	1–20
Report on the Propagation and Distribution of Food-Fishes. By W. de C. Ravenel	21–110
Report on Inquiry respecting Food-Fishes and the Fishing-Grounds. By Hugh M. Smith	111–140
Report of the Division of Statistics and Methods of the Fisheries. By C. H. Townsend	141–166

APPENDIXES.

Notes on the Fishes and Mollusks of Lake Chautauqua, New York. By B. W. Evermann and E. L. Goldsborough	169–175
Publications of the United States Commission of Fish and Fisheries available for Distribution on December 1, 1901	177–192
Notes on the Tagging of Four Thousand Adult Cod at Woods Hole, Mass. By Hugh M. Smith	193–208
Notes on the Fishes of Lake Ontario. By B. W. Evermann and W. C. Kendall	209–216
An Annotated List of the Fishes known to occur in Lake Champlain and its Tributary Waters. By B. W. Evermann and W. C. Kendall	217–225
An Annotated List of the Fishes known to occur in the St. Lawrence River. By B. W. Evermann and W. C. Kendall	227–240
Notes on the Silversides of the Genus Menidia of the East Coast of the United States, with Descriptions of two new Subspecies	241–267
Notes on the Scotch Methods of Smoking Haddocks. By Hugh M. Smith	269–271
Description of a new Species of Shad (Alosa ohiensis), with Notes on other Food-Fishes of the Ohio River. By B. W. Evermann	273–288
The Pan-American Exposition—Report of the Representative of the United States Fish Commission. By W. de C. Ravenel	289–351
Preliminary Report on an Investigation of the Fishes and Fisheries of the Hawaiian Islands. By D. S. Jordan and B. W. Evermann	353–380
Commercial Fisheries of the Hawaiian Islands. By John N. Cobb	381–499
Notes on the Fisheries of the Pacific Coast in 1899. By W. A. Wilcox	501–574
Statistics of the Fisheries of the Great Lakes. By C. H. Townsend	575–657
Statistics of the Fisheries of the Mississippi River and Tributaries. By C. H. Townsend	659–740
Notes on the Boats, Apparatus, and Fishing Methods employed by the Natives of the South Sea Islands, and Results of Fishing Trials by the Albatross. By A. B. Alexander	741–829

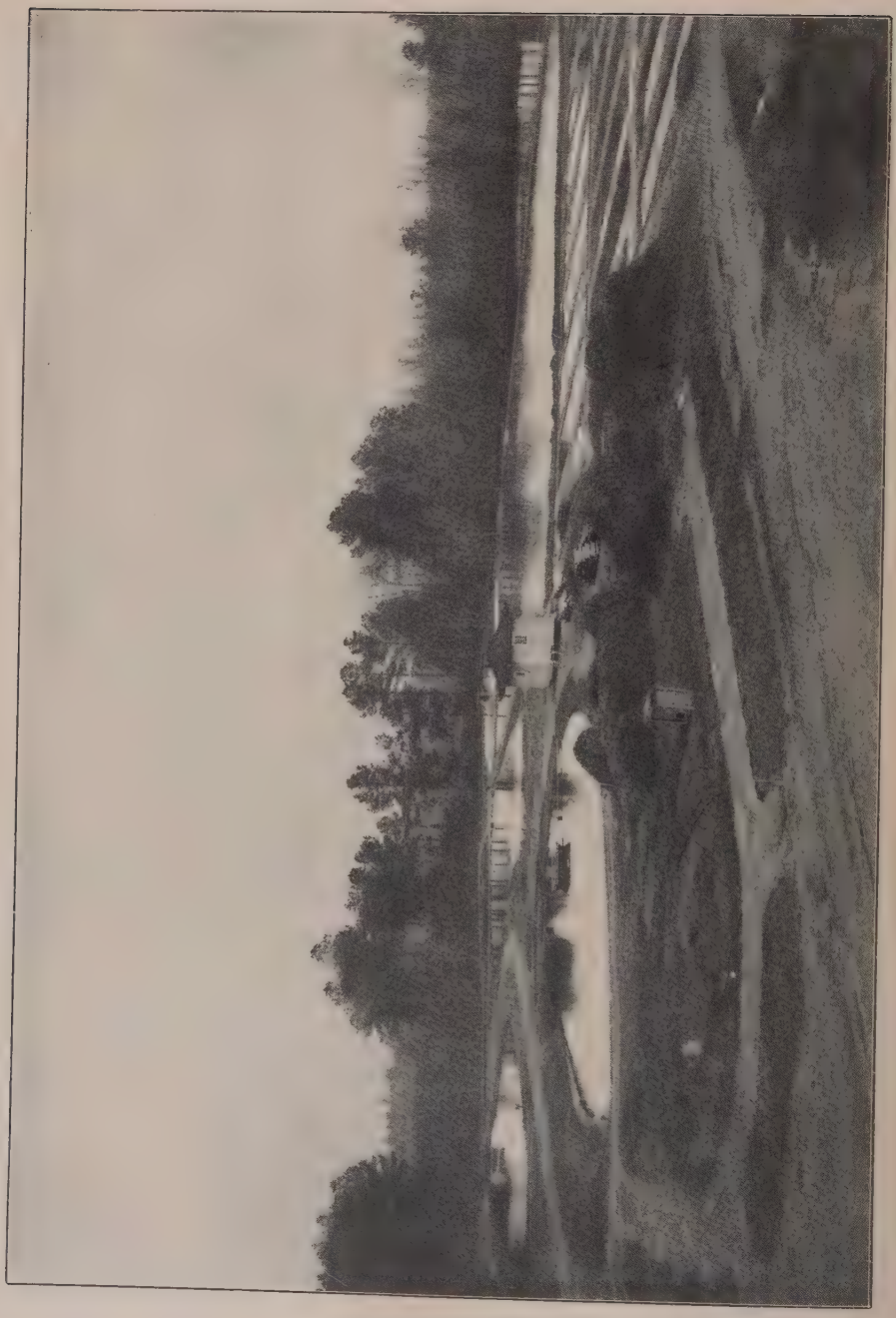
LIST OF ILLUSTRATIONS.

		Page.
Plate 1.	Spawning and Rearing Ponds at Bullochville, Ga	1
2.	Pan-American Exposition—Sections of Products of the Fisheries and Scientific Inquiry	16
3.	Pan-American Exposition—Fish-cultural Section	20
4.	General View of Bullochville Station, showing Pond System	54
5.	Cold Spring—Part of Water Supply at Bullochville	110
6.	Pan-American Exposition—Main Section of Government Building	291
7.	Pan-American Exposition—South Pavilion of Government Building, occupied by Fisheries Exhibit	298
8.	Pan-American Exposition—View taken from Gallery at North Door, showing Scientific Inquiry Section and Swordfish Fisherman	304
9.	Pan-American Exposition—View showing Beam Trawl in Position and other Scientific Apparatus	308
10.	Pan-American Exposition—View of the Fish-cultural Section, showing Hatching-trays, Tables, Spawn-taker, etc	314
11.	Pan-American Exposition—View showing Apparatus used in the Commercial Fishery, including the Angling Exhibit	322
12.	Pan-American Exposition—View showing Fishery Products and Angling Exhibit of Abbey & Imbrie	332
13.	Pan-American Exposition—Historical Series of Guns, Lances, etc., used in the Whale Fishery	336
14.	Pan-American Exposition—View showing Fishery Products	342
15.	Pan-American Exposition—View showing Cases containing Canned Products of the Fisheries	346
16.	Pan-American Exposition—Plan of Aquarium	352
17.	Pan-American Exposition—Details of Aquarium	352
18.	Pan-American Exposition—Details of Aquaria Tanks	352
19.	Pan-American Exposition—Plan of Pump and Refrigerating Room	352
20.	Pan-American Exposition—Diagram of Floor Space, Exhibition Hall	352
21.	(1) Native Fisherman with Dip Net. (2) Carrying Fish in Baskets	383
22.	(1) Double Canoe and Live-bait Box. (2) Double Canoe returning from Fishing	394
23.	(1) Squid Fishing with Spear. (2) Papai Dip Net	406
24.	(1) Puhi Basket Trap. (2) Fish Basket Trap	408
25.	(1) Interior Fish Pond, Waikiki, Oahu. (2) Sluiceway leading into Interior Fish Pond, Waikiki, Oahu	428
26.	(1) Banana Plantations. (2) Landing Fish (Aku) at Waiakea, Hilo	466
27.	Map showing Location of Fish Ponds on Molokai	476
28.	(1) Drying Abalone at a Camp of Japanese Fishermen near San Pedro, Los Angeles County, Cal. (2) Fishing a Salmon Trap, Puget Sound	503
29.	(1) Boxing Oysters on the Beds in San Francisco Bay. (2) Sorting Oysters for Market, San Francisco Bay	574
30.	Canoes Trading around the Steamship Albatross, Caroline Islands	743
31.	(1) Canoe, Makemo. (2) Canoes, Paddle, Dip Nets, and Fish-car, Papeete	768
32.	(1) Large Dip Net, Aitutaki. (2) Fish-trap, Aitutaki	778
33.	(1) Canoe, Kambara. (2) Canoe, Suva, Fiji	786
34.	(1) Fishing Trap Net closing in on School of Fish with short Drag Seines, Fiji Islands. (2) Fish-trap, Fiji Islands. (3) Fiji Canoe, Hut, and Native	792
35.	(1) Canoe, Funafuti. (2) Sailing Canoe, Rongelab	796
36.	(1) Marshall Island Canoe on Beach. (2) Marshall Island Canoe under Sail	804
37.	(1) Canoe, Kusaie, Caroline Islands. (2) Ponapi Canoe	822

TEXT CUTS.

	Page.
A Catch of Rainbow Trout from Laurel River, Va	25
Menidia peninsulæ	257
Menidia peninsulæ atrimentis	258
Menidia beryllina	260
Menidia beryllina cerea	263
Menidia menidia	263
Menidia menidia notata	263
Alosa ohiensis, female	279
Alosa ohiensis, male	279
Alosa alabamæ, male	280
Alosa alabamæ, female	280
Alosa sapidissima, male	281
Alosa sapidissima, female	281
Basket for catching Opai	408
Pearl Hook used in Aku Fishing	416
Bone Hooks used in Fishing	417
Wooden Shark Hooks with Bone Joints	418
Tortoise-shell Hook	418
Ivory Hook	418
Deep-sea Fishing Line	419
Cowrie Hook with Shell for catching Hee	420
Hook made from Iron Nail	420
Hooks used in catching Turtle and Squid	421
Hook with Ivory Barb and Wooden Shank	421
Mortar and pestle for mixing Palu (or Bait)	424
Striped Bass	504
Common Shad	504
Chinook, King, or Quinnat Salmon	506
Blueback or Red Salmon	506
Silver Salmon	509
Dog Salmon	509
Steelhead	512
Cod	524
Cultus-cod	525
Black Cod or Beshowe	525
Starry or California Flounder	527
Halibut	528
Pacific Herring	524
Surf Smelt	548
California Smelt	548
Bull's-eye or Chub Mackerel	569
Black-banded Rock-fish	571
Corsair	572
Tree-fish	573

	Page.
Canoe, Nukuhiva Island	745
Canoe, Rahiroa Island	748
Large and Small Adze used in making Canoes, Paumotu Islands	749
Stone Fish-trap, Apataki	752
Stone Fish-trap, Anaa Atoll, on the Reef	755
Cross Section of Makemo Canoe	759
Canoe, Nukutavake	766, 767
Fish-hooks, Hereheretue Island	768
Bamboo Fish-car, Papeete	772
Fish-trap, Papeete, side and end views	773
Fish-car, Bora Bora	778
Large Dip Nets, Aitutaki	779
Sketch of Half Canoe, Savage Island	781
Fish-trap, Nukualofa	784
Needle, Kambara, Fiji	787
Small Sailing Canoe, Fiji	789
Steering Paddle for Double Canoe, Kambara	790
Fish-trap, Funafuti	795
Scoop net, Funafuti	796
Sketch showing Stern of Funafuti Canoe	796
Canoe, Apamama and Tarawa	798
Sketch of Canoe showing Style of Planking, Apamama	799
Apamama Canoe Paddle	799
Stone Fish-trap, Maiana Island	800
Stone Fish-trap, Tarawa Island	801
Hand Net, Jaluit	803
String of Cocoanut Leaves used with Hand Net	803
Fish-trap, Jaluit	804
Sailing Canoe, Jaluit, Marshall Islands	805
Sketch of Marshall Island Canoe	807
Canoe Bailer, Marshall Islands	811
Dip Net, Rongelab	811
Showing Build of Rongelab Canoe	812
Fish-traps, Likieb Atoll	813
Dip Net, Kusaie	819
Wing-shaped Hand Net, Kusaie	820
Canoe and two Styles of Outrigger, Kusaie	821
Sailing Canoe, Truk Group	825
Paddling Canoe, Truk Group	826
Canoes on Beach, Truk Group	827
Double Fish-trap, Guam	828
Single Fish-trap, Guam	829



REPORT

OF THE

UNITED STATES COMMISSIONER OF FISH AND FISHERIES

FOR THE

FISCAL YEAR ENDING JUNE 30, 1901.

I have the honor to submit a report of the operations of the United States Commission of Fish and Fisheries for the year ending June 30, 1901, together with the detailed reports of the assistants in charge of the different branches of the work, and to call attention to some of the more interesting features.

PROPAGATION OF FOOD-FISHES.

The fish-cultural operations for the year show an increase of over 9,000,000 over 1900, 1,173,833,400 fish and eggs having been distributed, the principal species being shad, salmon, lake trout, white-fish, pike perch, lake herring, cod, and flat-fish, besides lobsters.

The results with salmon on the Pacific coast, though creditable, were inferior to some years, for while the runs of fish were good in the Sacramento and in the Columbia and its tributaries, the numbers reaching the headwaters, where the hatcheries are located, were comparatively small. Pursuing the policy mentioned in the last report, the fry in several instances were held for a few months and fed, so that when liberated they were 2 to 3 inches long and in vigorous condition. About 23,000,000 quinnat-salmon eggs were secured in California and Oregon and nearly 4,000,000 blueback eggs in Washington. On the Great Lakes the aggregate results were satisfactory, and besides the usual work in those waters plans were matured to begin the propagation of lake herring. The severe weather in January limited the results with this species to about 61,000,000 eggs, but greater success is expected during the coming year.

The collection of lake-trout eggs in Lakes Superior and Michigan nearly doubled that of last year, amounting to 22,400,000, from which 19,000,000 fry were hatched. Advantage was taken of the Michigan State law which permits the capture of fish for purposes of artificial propagation after the close season has begun, and a large proportion of these eggs were taken between November 14 and 28. The plan of impounding white-fish to insure a supply of spawning fish was again followed out successfully on the Detroit River and at several points on Lake Erie. The eggs were hatched at the stations on Lakes Erie,

Ontario, and Superior, and on the Detroit River, and yielded more than 326,000,000 fry, which were planted in those waters.

The Commission receives increasing numbers of requests for pike-perch fry for stocking inland lakes and streams, and is endeavoring to meet this demand. The taking of eggs of this species was again interrupted by storms on Lake Erie, but, on the whole, a satisfactory supply was obtained. This was augmented by over 160,000,000 taken on the Missisquoi River, in Vermont. From Lake Erie 42,000,000 eggs were sent to the State fish commissions of Michigan and Missouri, and 299,000,000 were held at the station at Put-in Bay. In all, 240,887,000 fry were hatched by the Commission and distributed.

In New England the customary work with marine species has been carried on, attention being paid chiefly to cod, flat-fish, and lobsters. Brood cod were collected by the schooner *Grampus* during October and held at Woods Hole until they were ready to spawn, and eggs were also obtained from fish taken by commercial fishermen at Kittery, Me., and at Plymouth, Mass. The hatching was done at Woods Hole and Gloucester. After the cod work was over at Woods Hole the propagation of flat-fish was taken up. It becomes each year more difficult to secure lobster eggs along the coast, notwithstanding agents are stationed at all of the important fishing centers. At the same time reports of statistical agents of the Commission show a slight increase in the number of lobsters brought to market in some ports of New England in the past year, as compared with 1898. During the year there were hatched and planted in New England waters 202,870,000 cod, 44,000,000 flat-fish, and 60,000,000 lobsters. The eggs obtained from lobsters taken on the Maine coast were hatched at Gloucester, but the fry were all returned to Maine waters.

The shad work of the season was satisfactory, although fewer fish were hatched than in the previous year, owing to weather conditions which caused the runs on the Potomac and Susquehanna to be much smaller than usual. On the Delaware, however, the fish were found in great quantities, and during the season, which lasted from May 6 to June 13, more eggs were taken than ever before. In Albemarle Sound the run was also very large, so that the new station at Edenton, N. C., operated for the first time, was enabled to make a very good showing. The total number of shad fry distributed was 193,287,000.

At the inland stations devoted to trout, bass, and other fish suitable to interior waters there have been good results, and nearly all of the applicants have been supplied with suitable numbers of fish for stocking purposes.

While the above refers briefly to the more important fish-cultural work of the Commission, a full list of the fishes propagated, with the number of each distributed, will be found on pages 85–110.

The Commission is often in receipt of letters showing the successful results of plants of fish in new waters made in previous years. It is reported that rainbow trout introduced in a lake in Ellis County,

Tex., in 1899, have so multiplied that there is now good fishing for them, and the same is also true of certain localities in Michigan and Virginia. Steelhead trout continue to thrive and multiply in Lake Superior and inland waters of Minnesota and Vermont, where they have been brought from the Pacific coast. On account of both its food and game qualities, this fish is an especial favorite in Minnesota, as evidenced by many appreciative letters. Lake trout introduced four years ago in a pond in Vermont have increased to such an extent that there is now good fishing there, as is also the case with black bass, of which a small plant was made under unfavorable circumstances in a pond in Massachusetts. These authentic notes of the value of fish-culture are referred to more in detail hereafter.

The following tables show the number of fish and eggs furnished to the States and Territories, the output of the various stations, and the total number of fish distributed by species during the fiscal year ended June 30, 1901:

Distribution and assignments of fish and eggs among the States and Territories.

State or Territory.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Alabama	Rainbow trout			1,800
	Black bass			2,350
	Crappie			1,590
	Rock bass			1,600
	Bream			1,250
Arizona	Rainbow trout			1,250
	Black bass			400
Arkansas	Rainbow trout			3,400
	Black bass			615
	Rock bass			100
	Strawberry bass			100
California	Quinnat salmon	3,402,036	889,570	
Colorado	Steelhead trout			47,800
	Rainbow trout		17,000	
	Black-spotted trout			1,170,000
	Brook trout		585,000	308,000
	Lake trout			21,250
Connecticut	Shad		8,828,000	
	Landlocked salmon			2,000
	Brook trout		40,975	
	Pike perch		500,000	
	Black bass			2,650
	Lobster		727,000	
Delaware	Shad		9,136,000	
	Brook trout			500
	Black bass			600
	Rock bass			150
District of Columbia	Shad			2,000,000
	Landlocked salmon		4,500	
	Rainbow trout			12
	Lake trout		13,600	
	Black bass			282
Florida	Shad		4,426,000	
	Black bass			1,900
	Crappie			200
	Rock bass			50
Georgia	Shad		2,575,000	
	Rainbow trout			2,900
	Sun-fish			258
	Black bass			5,720
	Crappie			2,011
	Rock bass			950
	Warmouth bass			306
	Bream			1,767
Idaho	Black-spotted trout	130,000	110,000	30,000
	Brook trout			11,000
	Grayling			3,500
	Steelhead trout			16,000
Illinois	White-fish	640,000		
	Pike perch		500,000	
	Cat-fish			100

Distribution and assignments of fish and eggs among the States—Continued.

State or Territory.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Illinois	Yellow perch			125
	Black bass			3,279
	Crappie			2,355
	Warmouth bass			550
	Sun-fish			375
Indiana	Rainbow trout		22,000	
	Brook trout		20,000	
	Lake trout		20,000	
	White-fish		4,000,000	
	Pike perch		9,500,000	
	Black bass			8,000
Indian Territory	Black bass			550
	Rock bass			350
	Strawberry bass			200
Iowa	Loch Leven trout			3,000
	Rainbow trout		124,000	5,235
	Brook trout		167,400	10,000
	Grayling			3,000
	Pike perch		1,000,000	
	Black bass			544
	Crappie			2,129
Kansas	Rainbow trout			500
	Black bass			8,180
	Crappie			250
	Rock bass			6,000
	Strawberry bass			700
	Bream			1,700
Kentucky	Rainbow trout			2,750
	Pike perch		2,000,000	
	Black bass			8,650
Louisiana	Black bass			1,025
	Crappie			100
	Rock bass			100
	Strawberry bass			975
	Bream			400
Maine	Atlantic salmon		10,000	182,620
	Landlocked salmon	20,855	359,923	186,009
	Steelhead trout		5,000	13,542
	Brook trout		437,529	235
	Lake trout	358,500	329,827	
	Lobster		15,000,000	
Maryland	Shad	5,235,000	44,826,000	
	Atlantic salmon		4,516	
	Loch Leven trout		9,342	
	Rainbow trout	20,000	7,816	9,550
	Brook trout		308	11,683
	Scotch sea trout		11,191	
	Pike perch		1,750,000	
	Black bass			11,825
	Rock bass			426
Massachusetts	Shad		397,050	
	Landlocked salmon	35,000		8,000
	Rainbow trout	90,000		431
	Brook trout	50,000	74,980	5,494
	Lake trout		5,000	
	Scotch sea trout	10,000		
	Pike perch	4,000,000	1,250,000	
	Black bass			1,550
	Cod		202,871,000	
	Flat-fish		44,230,000	
	Lobster		43,886,000	
Michigan	Landlocked salmon	10,000		
	Loch Leven trout		49,600	
	Rainbow trout	20,900	61,000	
	Brook trout		880,000	
	Lake trout	2,000,000	8,345,000	152,996
	Grayling	200,000		6
	White-fish		153,350,000	
	Pike perch	32,100,000	30,900,000	
	Black bass			2,790
	Crappie			300
Minnesota	Rainbow trout		19,900	
	Brook trout		80,000	3,000
	Lake trout		1,635,000	
	Pike perch		5,300,000	
	Black bass			230
	Crappie			600
Mississippi	Black bass			13,460
Missouri	Rainbow trout			67,350
	Brook trout	10,000		
	Pike perch	10,000,000		
	Black bass			720
	Crappie			200

Distribution and assignments of fish and eggs among the States—Continued.

State or Territory.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Missouri	Rock bass			1,495
	Strawberry bass			400
	Bream			3,430
Montana	Steelhead trout			20,000
	Brook trout			26,100
	Black-spotted trout		5,000	464,800
	Grayling		1,362,300	
	Black bass			1,050
Nebraska	Rainbow trout			2,000
	Black bass			105
	Crappie			400
New Hampshire	Atlantic salmon	200,000		
	Landlocked salmon	10,000		7,600
	Rainbow trout	25,000		
	Brook trout	25,000	129,495	52,126
	Lake trout	400,000	15,000	
	Grayling			519
	White-fish	500,000		
	Black bass			450
New Jersey	Shad	6,720,000	24,805,000	
	Rainbow trout	25,000		500
	Brook trout	20,000		
	Pike perch		1,500,000	
	Black bass			850
	Rock bass			100
New Mexico	Rainbow trout	44,960		15,875
	Black bass			1,300
	Rock bass			400
New York	Shad	42,000	16,386,000	
	Atlantic salmon			100
	Landlocked salmon	20,000		11,100
	Steelhead trout	25,000		5,598
	Brook trout		274,200	100
	Lake trout	2,800,000	1,470,000	
	Scotch sea trout			4,907
	White-fish	25,000,000	13,552,000	
	Pike perch		17,050,000	
	Black bass			4,250
North Carolina	Shad		51,280,000	
	Rainbow trout	75,000	5,000	8,650
	Brook trout			100
	Black bass			4,250
	Rock bass			1,540
North Dakota	Cat-fish			2,274
	Pickerel			300
	Yellow perch			496
	Black bass			3,235
	Crappie			492
	Sun-fish			65
Ohio	Brook trout		90,000	
	White-fish		102,600,000	
	Pike perch		86,587,200	
	Lake herring		20,200,000	
	Black bass			7,310
	Crappie			2,200
Oklahoma	Rainbow trout			2,000
	Black bass			1,950
	Rock bass			900
	Strawberry bass			100
Oregon	Quinnat salmon	2,728,000	8,030,510	1,668
	Silver salmon		128,000	
	Steelhead trout		65,850	25,000
	Rainbow trout		5,000	
	Brook trout		10,000	10,500
	Grayling		91,161	3,500
Pennsylvania	Shad		1,788,000	
	Atlantic salmon			64
	Steelhead trout			68
	Rainbow trout	25,000		57,277
	Brook trout	20,000		5,070
	White-fish	10,554,000	314,000	
	Pike perch		10,000,000	
	Lake herring	30,820,000		
	Black bass			5,985
	Rock bass			900
Rhode Island	Shad		2,249,950	
	Brook trout		20,000	
	Black bass			1,975
	Lobster		1,266,000	
South Carolina	Shad		5,504,000	
	Black bass			2,000
	Rock bass			350
South Dakota	Loch Leven trout		30,000	
	Black-spotted trout			2,071

Distribution and assignments of fish and eggs among the States—Continued.

State or Territory.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
South Dakota	Brook trout		190,000	140,000
	Black bass			1,860
	Crappie			825
Tennessee	Rainbow trout		8,000	64,075
	Brook trout		10,000	
	Pike perch		7,500,000	
	Black bass			5,540
	Rock bass			1,000
Texas	Rainbow trout			1,225
	Black bass			88,985
	Crappie			12,445
	Rock bass			8,265
	Strawberry bass			100
	Bream			7,695
Utah	Landlocked salmon	5,000		
	Rainbow trout	44,000		
	Black-spotted trout	20,000		
	Brook trout	25,000		
	Lake trout	300,000		
	Grayling	70,000		
Vermont	Landlocked salmon	10,000		21,982
	Steelhead trout			16,900
	Rainbow trout			2,998
	Brook trout		332,990	27,944
	Lake trout	300,000	106,400	
	Grayling			1,196
	Pike perch		16,750,000	
	Sturgeon		20,000	
	Black bass			1,000
Virginia	Shad		7,089,000	
	Rainbow trout		3,000	81,055
	Brook trout			8,167
	Black bass			16,345
	Crappie			285
	Rock bass			2,355
	Warmouth bass			175
	Sun-fish			390
Washington	Quinnat salmon		3,865,000	
	Silver salmon		172,041	
	Blueback salmon		3,834,453	
	Black-spotted trout			69,500
	Brook trout	25,000		25,900
	Lake trout		153,141	
	White-fish		791,295	
West Virginia	Rainbow trout	1,000		6,500
	Brook trout	25,000		750
	White-fish	5,000		
	Black bass			1,590
	Crappie			1,135
	Rock bass			100
	Sun-fish			180
Wisconsin	Quinnat salmon	25,000		
	Steelhead trout	50,000		
	Loch Leven trout	10,000		
	Rainbow trout		5,000	6,394
	Brook trout		6,855	6,537
	Lake trout		840,000	
	White-fish	10,000,000	4,800,000	
	Pike perch		2,700,000	
	Black bass			70
	Crappie			525
Wyoming	Steelhead trout	80,000		
	Loch Leven trout			10,000
	Black-spotted trout	75,000		
	Brook trout	151,000	45,000	25,000
	Lake trout	100,000		
	Black bass			35
	Crappie			2,425
Foreign countries:				
Canada	Lake trout		360,000	
	Black bass			150
Mexico	do			2,500
England	Rainbow trout	25,000		
Ireland	do	20,000		
Belgium	Landlocked salmon	10,000		
Italy	do	10,000		
New Zealand	Quinnat salmon	500,000		
Japan	Brook trout	10,000		
	Total	150,307,251	1,017,687,868	5,838,343

Fish and eggs furnished for distribution during year ending June 30, 1901.

Source of supply.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Green Lake, Me.*	Landlocked salmon	15,855	280,231	178,133
	Brook trout		437,529	59
	Lake trout	358,500	329,827	
	Steelhead trout			1,370
Craig Brook, Me.*	Atlantic salmon	200,000	10,000	182,884
	Landlocked salmon	115,000	3,000	3,114
	Steelhead trout		5,000	14,340
	Scotch sea trout	10,000		4,907
	Brook trout			170
Grand Lake Stream, Me	Landlocked salmon		76,692	33,862
	Brook trout			176
Nashua, N. H	Brook trout		191,000	88,175
	Grayling			540
St. Johnsbury, Vt	Brook trout	140,000	408,000	15,450
	Rainbow trout			3,841
	Steelhead trout			20,400
	Lake trout		121,400	
	Grayling			1,200
	Landlocked salmon			22,038
Gloucester, Mass	Cod		100,466,000	
	Lobster		47,270,000	
Woods Hole, Mass †	Cod		102,405,000	
	Flat-fish		44,230,000	
	Lobster		13,609,000	
Cape Vincent, N. Y	Pike perch	4,000,000	37,550,000	
	White-fish		13,552,000	
	Lake trout		1,485,000	
	Brook trout		274,200	
	Sturgeon		20,000	
Steamer Fish Hawk‡	Shad	10,955,000	52,813,000	
Battery Station, Md.§	Shad	1,042,000	45,393,000	
Fish Lakes, D. C	Black bass			‖64,280
	Crappie			1,531
	Shad			2,000,000
Central Station, D. C	Rainbow trout		7,816	
	Scotch sea trout		11,191	
	Loch Leven trout		9,342	
	Lake trout		13,600	
	Brook trout		308	
	Atlantic salmon		4,516	
	Landlocked salmon		4,500	
	Pike perch		1,750,000	
	Shad		¶82,650,000	
	White-fish		314,000	
Bryan Point, Md	Shad		**27,154,000	
Wytheville, Va	Rainbow trout	307,000	3,000	††162,480
	Brook trout			8,192
	Black bass			1,812
	Rock bass			8,370
Erwin, Tenn	Rainbow trout		13,000	76,125
	Brook trout		10,000	
	Black bass			1,258
Cold Springs, Ga	Black bass			275
	Warmouth bass			306
	Bream			3,367
	Sun-fish			258
Edenton, N. C	Shad		51,280,000	
Put-in Bay, Ohio‡‡	White-fish	10,554,000	125,100,000	
	Lake herring	30,820,000	20,200,000	
	Pike perch	42,100,000	156,587,000	
Northville, Mich	Lake trout	4,500,000	3,910,000	153,000
	Brook trout		991,250	
	Rainbow trout		72,000	
	Loch Leven trout	10,000	50,000	
Detroit, substation	White-fish	36,145,000	77,000,000	
Alpena, substation	White-fish		30,050,000	
	Lake trout		1,000,000	

*In addition to the above, there were transferred from Craig Brook station to other stations of the U. S. Fish Commission, 15,000 landlocked salmon eggs, 5,000 Atlantic salmon eggs, 2,000 Scotch sea trout eggs, and 500 brook trout eggs.

†In addition to the above there were transferred to Gloucester station for hatching 7,842,000 cod eggs, and 336,000 lobster fry were delivered to scientists.

‡26,757,000 shad eggs were also transferred from the *Fish Hawk* to various stations of the U. S. Fish Commission and 1,419,000 also to the Pan-American Exposition at Buffalo, N. Y.

§3,030,000 shad eggs were also transferred to Central Station, Washington, D. C.

‖350 black bass for breeders were transferred from Fish Lakes to Bullochville, Ga.

¶In addition to the above, 1,960,000 shad fry were also transferred from Central Station to the Fish Lakes retaining ponds, which are not included in this tabulation.

**1,011,000 shad eggs were also transferred from Bryan Point to Central Station.

††In addition to the above, 110,000 rainbow trout eggs were transferred from Wytheville to other stations of the U. S. Fish Commission.

‡‡In addition to the above, 21,592,000 white-fish eggs and 2,000,000 pike-perch eggs were transferred from Put-in Bay to other stations of the U. S. Fish Commission, and 6,000,000 pike-perch eggs were sent to the Pan-American Exposition at Buffalo, N. Y.

Fish and eggs furnished for distribution during year ending June 30, 1901—Cont'd.

Source of supply.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Sault Ste. Marie, substation.*	White-fish		18,000,000	
	Lake trout		700,000	
Duluth, Minn	Lake trout	1,400,000	†5,595,000	
	Brook trout		46,855	
	Rainbow trout		39,900	
	White-fish		14,600,000	
Quincy, Ill	Black bass			50,108
	Crappie			13,345
	Warmouth bass			725
	Sun-fish			945
	Cat-fish			100
	Yellow perch			125
Manchester, Iowa	Brook trout	10,000	257,500	19,600
	Rainbow trout		124,000	‡13,635
	Loch Leven trout			3,000
	Grayling			3,000
	Black bass			18,463
	Rock bass			2,350
	Crappie			4,470
	Sun-fish			65
	Pickerel			300
	Yellow perch			829
	Cat-fish			2,274
Neosho, Mo	Rainbow trout	109,860		§92,600
	Black bass			8,037
	Rock bass			9,345
	Strawberry bass			2,700
	Crappie			300
	Bream			5,730
San Marcos, Tex	Black bass			‖91,485
	Crappie			12,770
	Rock bass			8,090
	Bream			7,595
Leadville, Colo	Brook trout	¶160,000	585,000	308,000
	Black-spotted trout	95,000		1,170,000
	Rainbow trout		17,000	
	Lake trout			21,400
	Steelhead trout			47,800
Spearfish, S. Dak	Brook trout	**51,000	195,000	210,000
	Loch Leven trout		30,000	10,000
	Black-spotted trout			2,071
Bozeman, Mont.††	Black-spotted trout	130,000	115,000	566,000
	Brook trout			29,400
	Steelhead trout			36,000
	Grayling	270,000	1,362,300	7,000
Baird, Cal	Quinnat salmon	‡‡1,853,376	889,570	
Battle Creek, Cal	Quinnat salmon	§§2,073,660		
Clackamas, Oreg	Quinnat salmon		4,619,772	1,668
	Lake trout		153,091	
	Brook trout		10,000	
	Rainbow trout		5,000	
	Steelhead trout			25,000
	Grayling		91,161	
	White-fish		791,295	
Rogue River, substation	Quinnat salmon	1,100,000	1,850,085	
Elk Creek, substation	Silver salmon		128,000	
	Steelhead trout	‖‖155,000	65,850	
Little White Salmon, Oreg	Quinnat salmon	1,628,000	5,427,680	
Baker Lake, Wash	Blueback salmon		3,834,453	
	Silver salmon		172,041	

* In addition to the above, 70,117,000 white-fish eggs and 11,000 Loch Leven trout eggs were shipped by the Michigan stations to various stations of the U. S. Fish Commission, and for scientific or experimental purposes. Small numbers of various species of fish were shipped to the Pan-American Exposition at Buffalo, N. Y.

† In addition to the above, 700,000 lake-trout eggs were transferred from Duluth to other stations of the U. S. Fish Commission.

‡ 126,000 rainbow-trout eggs were also transferred to other stations of the Commission.

§ In addition to the above 73,672 rainbow-trout eggs were transferred from Neosho to Northville station and 500 to the Indiana University, at Bloomington, Ind.

‖ Of the black bass, 2,500 were furnished in 1900. Sent to Mexico and not tabulated last year.

¶ 250,000 brook-trout eggs were also transferred to various stations of the Commission.

** In addition to the above, 150,000 brook-trout eggs were transferred from Spearfish to other stations of the U. S. Fish Commission.

†† In addition to the above, 100,000 grayling eggs were transferred from Bozeman to Clackamas, and 20,000 black-spotted trout eggs, 13,000 steelhead trout eggs, and 20,000 grayling eggs were sent to the Pan-American Exposition.

‡‡ 1,000 quinnat-salmon eggs were also sent from Baird to Prof. Dudley, of Stanford University.

§§ 1,000,000 quinnat salmon eggs were also transferred from Battle Creek to Baird for hatching, and 6,000 were sent to Stockton, Cal., high school for experimental purposes.

‖‖ In addition to the above, 91,000 steelhead trout eggs were transferred from Elk Creek to other stations of the U. S. Fish Commission.

Summary of distribution.

Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.	Total.
Shad	11,997,000	179,290,000	2,000,000	193,287,000
Quinnat salmon	6,655,036	12,785,080	1,668	19,441,784
Atlantic salmon	200,000	14,516	182,784	397,300
Landlocked salmon	130,855	364,423	236,691	731,969
Silver salmon	.....	300,041	.....	300,041
Blueback salmon	.....	3,834,453	.....	3,834,453
Steelhead trout	155,000	70,850	144,908	370,758
Loch Leven trout	10,000	88,942	13,000	111,942
Rainbow trout	415,860	277,716	343,727	1,037,303
Black-spotted trout	225,000	115,000	1,736,371	2,076,371
Brook trout	361,000	3,394,732	678,206	4,433,938
Lake trout	6,258,500	13,292,068	174,246	19,725,714
Scotch sea trout	10,000	11,191	4,907	26,098
Grayling	270,000	1,453,461	11,721	1,735,182
White-fish	46,699,000	279,407,295	.....	326,106,295
Pike perch	46,100,000	194,787,200	.....	240,887,200
Lake herring	30,820,000	20,200,000	.....	51,020,000
Sturgeon	.....	20,000	.....	20,000
Cat-fish	.....	.....	2,374	2,374
Pickerel	.....	.....	300	300
Yellow perch	.....	.....	621	621
Black bass	.....	.....	228,105	228,105
Crappie	.....	.....	30,467	30,467
Rock bass	.....	.....	27,131	27,131
Strawberry bass	.....	.....	2,575	2,575
Warmouth bass	.....	.....	1,031	1,031
Sun-fish	.....	.....	1,268	1,268
Bream	.....	.....	16,242	16,242
Cod	.....	202,871,000	.....	202,871,000
Flat-fish	.....	44,230,000	.....	44,230,000
Lobster	.....	60,879,000	.....	60,879,000
Total	150,307,251	1,017,687,868	5,838,343	1,173,833,462

RAILROAD TRANSPORTATION.

The cars of the Fish Commission, while distributing fishes, traveled 103,982 miles and detached messengers traveled 200,473 miles. The following railroads greatly aided the work of distribution by furnishing free transportation:

Name of railroad.	Cars.	Messengers.	Name of railroad.	Cars.	Messengers.
Atchison, Topeka and Santa Fe Rwy. System	.....	370	Kansas City Southern Rwy	24	.....
Austin and Northwestern R. R	.....	489	Lexington and Eastern Rwy	.....	140
Baltimore and Ohio R. R	412	.....	Maine Central R. R	1,476	1,780
Bangor and Aroostook R. R	958	927	Michigan Central R. R	400	.....
Boston and Maine R. R	.....	7,263	Mobile and Ohio R. R	1,893	.....
Burlington, Cedar Rapids and Northern Rwy	1,461	1,601	Monson R. R	.....	12
Central Vermont Rwy	.....	883	Montana R. R	188	.....
Chesapeake and Ohio Rwy	779	.....	Montpelier and Wells River R. R	.....	249
Chicago and Northwestern Rwy	.....	422	Natchitoches and Red River Valley Rwy	.....	22
Chicago, Burlington and Quincy R. R	4,374	8,192	Northern Pacific Rwy	5,780	673
Chicago, Milwaukee and St. Paul Rwy	104	.....	Oregon R. R. and Navigation Co	.....	636
Colorado and Southern Rwy	.....	3,466	Oregon Short Line R. R	854	.....
Colorado Midland Rwy	.....	1,031	Pennsylvania R. R. System	501	.....
Colorado Springs and Cripple Creek District Rwy	.....	108	Pere Marquette R. R	648	.....
Delaware and Hudson R. R	120	.....	Philadelphia and Reading Rwy	.....	44
Denver and Rio Grande R. R	.....	10,034	Plant System	591	359
Detroit and Mackinac Rwy	1,310	.....	Portland and Rumford Falls Rwy	252	.....
El Paso and Northeastern R. R	326	.....	Rutland R. R	.....	666
Erie R. R	.....	252	St. Louis and San Francisco R. R	1,108	.....
Florida East Coast Rwy	.....	732	St. Louis Southwestern Rwy	.....	339
Fort Worth and Denver City Rwy	.....	4,857	San Antonio and Aransas Pass Rwy	.....	1,146
Grand Rapids and Indiana Rwy	3,196	.....	Seaboard Air Line Rwy	2,829	.....
Grand Trunk Rwy. System	.....	172	Somerset Rwy	82	.....
Great Northern Rwy. Line	1,171	1,057	Southern Pacific R. R	.....	1,205
Gulf, Colorado and Santa Fe Rwy	.....	8,024	Texas and Pacific Rwy	2,654	4,511
Houston and Texas Central R. R	.....	1,723	Texas Central R. R	.....	344
International and Great Northern R. R	.....	9,501	Texas Midland R. R	.....	125
Kansas City, Fort Scott and Memphis R. R	1,107	.....	Union Pacific R. R	.....	326
			Wabash R. R	2,445	1,581
			Washington County R. R	56	204
			Total	37,099	75,466

BIOLOGICAL INQUIRIES.

The investigations and experiments addressed to the fishes and other aquatic animals which are of immediate or indirect usefulness to man have, as usual, covered a wide range of subjects, as noticed in some detail in the appended report of the assistant in charge of this branch of the Commission's work.

In continuation of the policy of extending knowledge of the resources of the fresh waters and the geographical distribution of the food, game, and bait fishes, explorations have been carried on in Maine, West Virginia, Ohio, Indiana, Illinois, Michigan, Iowa, Nebraska, and California—some of a general character and some addressed to particular species.

Investigations having reference to the animal life in the coastal waters were conducted in Maine, Massachusetts, Rhode Island, Virginia, North Carolina, Florida, Alabama, Mississippi, Louisiana, Texas, and California. Special experiments of economic importance related to the artificial fattening of oysters for market, the growing of sponges from cuttings, the rearing of lobsters, and the establishment of clam farms. The last two subjects were considered by the special commission formed for this purpose in the previous year, and material progress has been made in developing rational measures for maintaining the supply of lobsters and clams on the East coast.

The investigation of the fisheries of the Hawaiian Islands required by the act of Congress which provided a government for Hawaii was begun in June, 1901. It was recognized at the outset that a satisfactory study of this subject, as contemplated by Congress, would involve a thorough inquiry into the variety, abundance, distribution, habits, etc., of the fishes and other aquatic products of this archipelago; and it was therefore decided that the preliminary investigations which were completed during the year should, without neglecting the purely commercial aspects of the subject, be directed primarily to the marine zoology of the Territorial waters.

The intelligent consideration of the diseases of fishes, whether wild or under domestication, has demanded and received much attention. An assistant has been regularly assigned to this duty; special facilities and apparatus have been furnished for the prosecution of his studies, and it is hoped that before long the Commission will be in position to control some of the disastrous fish epidemics which now prevail at the hatching stations.

The marine biological laboratories maintained by the Commission at Woods Hole, Mass., and Beaufort, N. C., have been resorted to by a very large corps of eminent biologists from all parts of the country. The Commission has had the benefit of the many important investigations relating to both pure and applied sciences there carried on. The provision made by Congress for a permanent laboratory at Beaufort is highly appreciated by the scientists who have been accus-

tomed to visit this place, and it is evident that the new laboratory will attract many workers and prove of great benefit in promoting a knowledge of the fauna of the South Atlantic coast waters.

The evident desire of Congress to establish a biological station on the Gulf coast, as the Commission has recommended, has led to an examination of the entire region for the purpose of determining the physical, climatic, and faunal advantages of the various sites which have been suggested.

A number of inquiries having pertinency to work of this division or to the fisheries of the United States were made by the assistant in charge in several European countries. Among these was the sardine industry of France, on which a special report has been issued.

STATISTICAL INQUIRIES.

It is not possible, with the comparatively small force available for the purpose, to canvass the entire country in one year, and the different regions are therefore taken up in turn, three or four years being necessary to investigate all of our fisheries. During the past fiscal year investigations have been made on the Great Lakes, the Mississippi River and tributaries, and the Pacific Coast States. The statistics which follow, in the report of the division of statistics and methods of the fisheries (pp. 141–166), refer to the calendar year 1899, and much of the information has already been published in advance bulletins. Some miscellaneous field work was also done relating to minor interior waters of Texas, Utah, and Nevada, where an amount of fishing is carried on which is of considerable local importance. There have also been included studies of some of the more important or specially interesting fisheries, such as those of Boston and Gloucester, the sponge fishery of Florida, the lobster fishery, etc. Although the work is principally statistical, information is gathered respecting the methods employed, and intimate relations are maintained with all of the fishing and fish-dealing firms, whose interest in the work is revealed by the constant applications for information. Not only the commercial value of the fisheries, but the results of fish-culture, are shown by the statistics, as it is found that millions of pounds of fish are taken annually from waters artificially stocked in which such species did not previously exist.

Besides the usual monthly bulletins covering the principal fishery products landed at Boston and Gloucester, five special bulletins containing advance information have been issued during the year.

At Boston and Gloucester there have been landed during the calendar year 1900, 162,218,900 pounds of products, valued at $4,385,000, a decrease of 14,555,000 pounds from the previous year, but an increase of $191,450 in value. Boston shows an increase both in quantity and value, while in Gloucester there was a falling off in quantity.

The mackerel fishery for 1900, amounting to 87,967 barrels, was larger than for any year except 1888 since the marked decline of this

industry, which began in 1885. This has been regarded as an indication that this industry might regain its former importance, though the results of the season of 1901 have so far not been so encouraging.

The canvass of the Great Lakes for the calendar year 1899 shows that the yield and value were nearly equal to those of 1890, the largest on record. The total yield was 113,728,000 pounds, worth $2,611,400. There were 9,670 persons engaged in the fisheries and $6,617,000 invested. The most important species, commercially, was the herring, followed by the lake trout, pike, pike perch, and white-fish. The values of the fisheries in the different lakes vary considerably, from Lake Erie, where they are worth $1,150,900, to Lake Ontario, which yielded products valued at $101,000.

In recent years the fisheries of the Mississippi and its tributaries have developed to such a degree that in 1899 they exceeded in quantity and nearly equaled in value the entire yield of the remaining interior waters of the United States, except the Great Lakes. The most important products are buffalo-fish, cat-fish, and German carp. Mussel shells, extensively used in the manufacture of pearl buttons, were another valuable item, some 45,500,000 pounds being secured, for which the fishermen obtained $207,000.

There has been a marked increase in the fisheries of California, Oregon, and Washington since 1895, when the last canvass of those States was made. This is owing in great measure to the extension of the salmon-canning industry in northern Washington. The total investment in these three States is $12,873,000, and employment is given to nearly 20,000 people. Since 1895 the investment has increased by $5,600,000. The salmon fishery is altogether the most valuable, being worth to the fishermen $3,500,000, but oysters, whale products, cod, and halibut are also important factors.

In Florida, since 1890, the decreasing supply of sheep's-wool sponges, the favorite commercial grade, has brought about an advance in price and also a demand for other qualities. In the aggregate, while the number of sponges taken is smaller, the value is considerably greater. In 1900, 365,000 pounds were taken, worth $567,600.

In July, 1900, the assistant in charge of the Division of Fisheries visited the Pribilof Islands to obtain data regarding the fur-seal herd for the Treasury Department, as required by law. His report was made to that Department. It was found the number of seals born in 1900 was not much less than in the previous season, attributable probably to the small pelagic catch in 1897. About 5,000 more skins were taken than in 1899, owing to their increased value, which influenced the lessees of the islands to kill some 13,000 two-year-olds. It has always been customary to confine the take of skins to seals three years old, but in 1900 only 9,000 of this class could be found. The report calls attention to the fact that the increased catch of pelagic seals during the past two seasons does not indicate that the herd is becoming more plentiful, for while the average take by each vessel is

good, the fleet is now about half the size it was formerly. The only way to arrive at a knowledge of the size of the herd is by actual count on the islands during the breeding season.

STEAMER ALBATROSS.

On July 1, 1900, the *Albatross* was at Unalaska on her way to Bering Sea to continue the investigation of the salmon fisheries of Alaska, begun in 1897, and which it was impossible to follow up during the two succeeding years, on account of other demands on the vessel. The cruise extended to Bristol Bay and along the south side of the Alaskan peninsula and the coast of southwestern Alaska, the object being to visit those salmon streams and canneries which were omitted in 1897 and to verify and complete records made at that time. The vessel was engaged in this duty till the close of the season, arriving at San Francisco October 30. The great distances to be traveled and the short seasons of those northern latitudes made it impossible to collect all the desired data, and therefore, owing to the importance of the work commercially and the interest shown in the previous report, it was deemed expedient to continue the investigation during one more summer, which it was thought would complete it and make available a comprehensive and thorough knowledge of these valuable fisheries. Accordingly, on the 22d of May, 1901, the vessel sailed from Seattle, and at the close of the fiscal year was again in Alaskan waters. The report of the commanding officer is now in preparation for publication.

STEAMER FISH HAWK.

This vessel was used during the summer of 1900 in connection with the biological work at the Woods Hole laboratory. After refitting and undergoing certain repairs she proceeded, November 10, to Pamlico Sound, North Carolina, to continue the hydrographic survey of the oyster-grounds of that region, begun the previous year. The work was confined to the section in Wyesocking Bay, surveyed by Lieutenant Winslow in 1887, to determine what changes had occurred since that date, and it was found that these public oyster-grounds had decreased materially in area and productiveness.

On completion of this duty the vessel proceeded to the Gulf coast of Florida to survey and chart the sponge-grounds, in connection with the investigation of the sponge industry of that State. Leaving Hampton Roads January 7, 1901, she arrived at Anclote anchorage, Florida, January 20. On account of boisterous weather the work of the survey was greatly interfered with, and but a very small part of the beds was examined and located. The grounds extend from St. Marks to Tampa Bay, a distance of 150 miles, and out from the shore 15 to 20 miles to a depth of 60 feet, which is the limit of depth at which the fishermen can work with present appliances. During the latter part of March a series of hauls with dredge and beam trawl were made for collections of invertebrates and fishes. April 3 the vessel reached

Key West, preparatory to proceeding north for the usual shad propagation. This work was taken up in the Delaware River, off Gloucester City, and though the season was backward, no eggs being taken till May 6, the results were very successful and operations were continued till June 13.

NEW STATIONS.

Work at the new stations under construction when the last report was submitted has been continued, and the stations at Bullochville, Ga., and Nashua, N. H., completed so that fish-cultural operations have been begun.

At Cold Spring station, near Bullochville, 5 of the ponds finished in 1900 have been considerably enlarged, and 8 new large ponds and 33 small rearing-ponds have been built, giving a total pond area of 6 acres. An office and storehouse, 25 feet by 43 feet, and a stable, 20 feet by 30 feet, have been erected, and fencing, driveways, and grading finished. Water is supplied to the residence, stable, and grounds by means of a hydraulic ram.

At Nashua, N. H., a ditch 630 feet long, 3 feet wide, and 2 feet deep, was excavated along the pond system to protect it from the effects of storms. Fourteen new rearing-ponds were completed, 8 wells driven, new flumes constructed, shade trees planted, and other minor work performed.

At Edenton, N. C., the attempt to obtain water for bass ponds by means of artesian wells has not proved a success, the flow being entirely inadequate for that purpose. Accordingly some of the marsh land on the station has been cleared of cypress trees and stumps and the construction of ponds begun where they may be supplied with water from Pembroke Creek. This ground is so low that the proposed ponds must be drained by pumping, and a plant for this purpose has been installed. The necessary outbuildings have been erected, boats and equipment purchased, and the upper floor of the hatchery strengthened to provide quarters for the station force.

NORTH CAROLINA BIOLOGICAL STATION.

The act of Congress approved May 12, 1900, authorizing the establishment of a biological station and laboratory in North Carolina, contained no provision for the purchase of land. Though this defect would doubtless have been rectified at the next session of Congress, the opening of the laboratory would have been delayed at least a year and a half. To avoid this delay several institutions of learning interested in the early completion of the station, at the suggestion of Prof. J. A. Holmes, State geologist of North Carolina, subscribed the amount necessary to purchase the desired property, and, by a deed dated March 25, 1901, donated it to the Government, subject to no conditions. While this action was very gratifying, since it permitted work to be begun at once, it was taken independently by the donors, without the advice or solicitation of the Commission. After due

consideration and investigation it was believed that the waters about Beaufort offered exceptional advantages for the proposed station, as there could be found material in abundance for the study of marine life, and the opportunities for consideration of economic problems were equally varied. The site finally decided on was Pivers Island, which is about 3 acres in extent, and lies in Beaufort Harbor, some 150 yards west of the city of Beaufort. As soon as the land was acquired the preparation of plans and specifications was begun by the architect and engineer, bids were advertised for, and arrangements made to begin work. The sum necessary for the purchase of the site, $400, was subscribed by Johns Hopkins University, Baltimore; University of Virginia, Charlottesville; University of North Carolina, Chapel Hill; South Carolina College, Columbia, and University of Georgia, Athens.

EXPOSITIONS.

The exhibit of the Commission at the Pan-American Exposition, which was opened May 1 at Buffalo, N. Y., and at the close of the year was in progress, was under the charge of Mr. W. deC. Ravenel, who was appointed representative on the Government board of managers April 28, 1899.

The exhibit occupies about 10,000 square feet and is intended to show the functions of the Commission as provided for by law, and also to illustrate, as comprehensively as the space will allow, the methods employed in the various fisheries and to show their products. The exhibits are arranged under three general headings—scientific inquiry, fish-culture, and products.

An aquarium, which occupies about 6,500 square feet, and in which are 32 tanks, has been arranged around the sides of the building. In these are shown all of the fresh and salt water fishes propagated by the Commission, the important economic food-fishes of the North Atlantic coast and the inland waters east of the Rocky Mountains and a few of the *Salmonidæ* from the Pacific slope. Arrangements have also been made with the New York and Vermont State fish commissions for collections of game fishes indigenous to those States.

The tanks for the display of fresh-water fishes are supplied with water from the Niagara River, which is furnished free of expense by the exposition company. The salt water was brought from Woods Hole, Mass., transported in cars loaned by the Union Tank Line Company of New York.

In the interior portion of the building, which has an area of 3,540 square feet, the exhibits are placed.

In the section of scientific inquiry are illustrated the methods and apparatus employed in conducting investigations and some of the results attained. Most of the instruments used in the laboratory—microscopes, microtomes, dissecting instruments—are well known to the public, and the purpose has been, therefore, to utilize the space to show apparatus used in making shore and deep-sea collections.

Facing the aisles are models of the *Albatross* and the *Fish Hawk*, the largest vessels belonging to the Fish Commission, to which are due much of the present knowledge of the life in the deep waters off the coasts of the United States and in the West Indies. Running diagonally across the section from the circular aisle of the rotunda is a display of the common forms of apparatus employed in marine investigation. The beam trawl, which is spread upon the floor, is used for gathering specimens from the bottom. Hanging to a frame above the trawl are appliances used in collecting from the surface, bottom, and intermediate depths, such as the tangle, the Chester dredge, boat dredges, and surface and intermediate tow nets.

Draped on the frame and otherwise disposed about the section are seines, gill nets, scoop nets, scrape nets, and other apparatus used in making shore collections of fishes and other organisms. The collecting tanks and chests in which specimens are preserved and transported are shown by the side of the trawl, and adjacent to them is a Tanner sounding machine, with its accessory apparatus. On the walls in frames are examples of plates, colored and black-and-white, used to illustrate the publications of the Commission, and charts of the geographical distribution of certain food-fishes, and a large map showing where the Commission has carried on scientific investigations.

Under the head of fish-culture are grouped the exhibits which illustrate fish-cultural work, embracing full-size forms of apparatus and models of all the appliances used in collecting eggs, the hatching and distribution of fresh and salt water fishes, and photographs, drawings, and charts showing the different phases of the work and the results of fish-culture in certain of the fisheries. From the opening of the exposition to its close, October 30, the practical work of hatching trout, salmon, shad, pike perch, and other fishes will be demonstrated. Suitable troughs and other apparatus have been provided and supplies of eggs will be received from time to time from different parts of the country. At the opening of the exposition eggs of the shad, pike perch, steelhead trout, grayling from Montana, and black-spotted trout were in process of hatching. As the season advances other eggs will be substituted. The hatching of eggs of the marine fishes is illustrated by artificial means, as none of the salt-water fishes propagated by the Commission spawn during the summer.

Fishery products are shown in a comparatively small but comprehensive display of various fishes, oysters, lobsters, clams, turtles, shrimp, etc., preserved by canning in various ways, and by smoking, pickling, and salting. The fresh-fish industries are illustrated by casts and engravings of the principal food-fishes, and pictures showing the manner of their capture. There is also a series of shells of salt and fresh water mollusks which are used for food or bait, and a collection of edible crustaceans preserved and mounted. The secondary products of the fisheries, which are of considerable and increasing value, are illustrated by glues, fertilizers, oils, and isinglass. There are

also examples of walrus and narwhal tusks, sperm-whale teeth, baleen or whalebone, both crude and prepared for use; and the well-known tortoise shell, in the form of shells, rough and polished, of the hawk's bill or tortoise-shell turtle. The Florida sponge fishery is represented by dried specimens of different grades and sizes.

A full series of the shells of mollusks utilized in button-making is shown, together with buttons in the various stages of manufacture. The mollusks yielding shells suitable for buttons are among the numerous species which produce pearls, many of which are very beautiful and valuable, and examples of these are added to the collection. The skins of some water animals and fishes are now largely utilized in the manufacture of leather goods of all kinds, and a number of samples of these leathers are exhibited, including the skins as they appear when first tanned and the leathers dressed and dyed for different purposes. A display of furs of water animals, for the loan of which the Commission is indebted to Mr. C. C. Shayne, of New York, illustrates fishery products used for clothing, and represents the furs in their various stages of manufacture.

There are models of the modern types of fishing vessels, vessels used on the Atlantic, Pacific, and Gulf coasts, and the various nets, seines, lines, hand-lines, trawls, etc., are exhibited by models and by full-size specimens where space will permit.

The exhibit is proving very attractive and is nearly always crowded. The amount of space available was so limited that the aisles were necessarily too narrow both for comfort and to allow visitors a proper opportunity to examine the various collections, the passages of the aquarium especially being often so filled that it was impossible to have more than a passing glimpse of the tanks.

An act of Congress approved July 1, 1898, directed that the United States be represented at the Universal Exposition of 1900 at Paris (commencing April 15 and closing November 5, 1900) by a commissioner-general, who was authorized to call on various branches of the Government, including the Fish Commission, for such material in their possession as he desired for exhibit at the exposition. Accordingly, at his request, this Commission furnished to Dr. T. H. Bean, director of forestry and fisheries on the staff of the commissioner-general, the following exhibits, which at the close of the exposition were duly returned: Series of casts of food-fishes; series of photographs illustrating methods of preparing fishery products for food; series of large photographs of fish-cultural stations; series of photographs illustrating Alaskan fishery methods and scenery; series of water-color drawings of fishes of United States and Porto Rico; series of publications of the Commission; models and specimens of fish-cultural apparatus; model of transportation car; model of fish hatchery; collection of Florida commercial sponges; collection of oyster-shells, illustrating growth and development; collection of fresh-water mussels, illustrating the mussel fishery and the manufacture of pearl buttons.

On October 15, 1900, this Commission was notified that it had been awarded the diploma of a grand prix for its collective exhibit.

The following members of the Commission staff individually exhibited sets of their published papers pertinent to the work of the Bureau, and were awarded the stated prizes:

Gold medals: Dr. H. M. Smith, Dr. B. W. Evermann.
Silver medals: Dr. J. A. Henshall, Mr. C. H. Stevenson, Mr. W. A. Wilcox.
Bronze medals: Dr. W. C. Kendall.
Honorable mention: Mr. John W. Titcomb.

The following additional awards were made wholly or partly for reports, either published by the Commission or based on its work.

Gold medals: Commander Z. L. Tanner, U. S. N.; Dr. D. S. Jordan, Dr. T. H. Bean, Dr. L. Stejneger.
Silver medals: Dr. W. O. Atwater, Prof. Edwin Linton.
Bronze medals: Dr. H. C. Bumpus, Dr. S. E. Meek, Dr. A. J. Woolman, Dr. P. H. Kirsch.

Silver medals were awarded to Mr. A. H. Baldwin and Mr. C. B. Hudson, for water-color drawings of fishes made to illustrate publications of the Commission.

In connection with the Paris Exposition, an International Congress of Agriculture and Fisheries was held under the auspices of the French Government. Dr. H. M. Smith was designated to represent the Commission at this congress, and his account of the proceedings will be found on pp. 133–139. Attention is drawn to the series of formal views adopted by the congress relating to fishery matters of international interest.

AMERICAN FISHERIES SOCIETY.

The American Fisheries Society held its twenty-ninth annual session at the Woods Hole station of the Commission, beginning July 18, 1900. The society is the only organization of the kind in the United States, and has a large membership of persons in all parts of the country who are interested in fisheries and fish-culture. The Commission has always been in hearty sympathy with the objects and work of the society, of which many of its staff are active members; and it was at the special invitation of the Commission that the meeting was held at Woods Hole.

The attendance was large, and the meeting, which continued for three days, was one of the most interesting and profitable in the history of the society. Besides the reading and discussion of a number of unusually valuable papers, the members witnessed the workings of the hatchery and biological laboratory at Woods Hole, made several trips on the vessels of the Commission, had a demonstration of deep-sea sounding and dredging on the steamer *Fish Hawk*, and visited a number of private trout hatcheries in Massachusetts and Rhode Island.

PUBLICATIONS.

There have been added to the library during the year 164 books and 288 unbound volumes and pamphlets. Besides the bound report for 1899, the following pamphlet extracts from the reports for 1899 and 1900 and the bulletin for 1899 have been published:

Description of two new species of darters from Lake Maxinkuckee, Indiana, by B. W. Evermann. Report for 1899, pp. 363–369.

The sturgeon fishery of Delaware River and Bay, by John N. Cobb. Report for 1899, pp. 369–380.

Report of the Commissioner for the fiscal year ending June 30, 1899, by G. M. Bowers. Report for 1899, pp. VII–CLXIII.

The gas-bubble disease of fish, and its cause, by F. P. Gorham. Bulletin for 1899, pp. 33–37.

The clam problem and clam culture, by J. L. Kellogg. Bulletin for 1899, pp. 39–44.

Description of new species of fishes from the Hawaiian Islands, belonging to the families of *Labridæ* and *Scaridæ*, by O. P. Jenkins. Bulletin for 1899, pp. 45–65.

Rotatoria of the United States, with special reference to those of the Great Lakes region, by H. S. Jennings. Bulletin for 1899, pp. 67–104.

A report of work on the protozoa of Lake Erie, with special reference to the laws of their movements, by H. S. Jennings. Bulletin for 1899, pp. 105–114.

Notes on a collection of fishes from the rivers of Mexico, with description of twenty new species, by D. S. Jordan and J. O. Snyder. Bulletin for 1899, pp. 115–147.

Notes on the Florida sponge fishery in 1899, by H. M. Smith. Bulletin for 1899, pp. 149–151.

Chemical changes in the developing fish egg, by P. A. Levene. Bulletin for 1899, pp. 153–155.

The free-swimming copepods of the Woods Hole region, by W. M. Wheeler. Bulletin for 1899, pp. 157–192.

Observations on the life history of the common clam, by James L. Kellogg. Bulletin for 1899, pp. 193–202.

Natural history of the starfish, by A. D. Mead. Bulletin for 1899, pp. 203–224.

Movements of certain lobsters liberated at Woods Hole, by H. C. Bumpus. Bulletin for 1899, pp. 225–230.

Improvements in preparing fish for shipment, by R. W. Tower. Bulletin for 1899, pp. 231–235.

Report of a dredging expedition off the southern coast of New England, by Freeland Howe. Bulletin for 1899, pp. 237–240.

Lobster fishery of Maine, by John N. Cobb. Bulletin for 1899, pp. 241–265.

Fish parasites collected at Woods Hole in 1898, by Edwin Linton. Bulletin for 1899, pp. 267–304.

Biological notes from Woods Hole. Bulletin for 1899, pp. 305–310.

Skeleton of the black bass, by R. W. Shufeldt. Bulletin for 1899, pp. 311–320.

Chemical composition of subdermal connective tissue of ocean sun-fish, by E. H. Green. Bulletin for 1899, pp. 321–324.

Report of the Commissioner for the year ending June 30, 1900, by George M. Bowers. Report for 1900, pp. 1–191.

Investigations of the aquatic resources and fisheries of Porto Rico by United States Fish Commission steamer *Fish Hawk*. General report, fisheries and fish trade and the fishes of Porto Rico.

A method of recording egg development for use of fish-culturists, by Claudius Wallich. Report for 1900, pp. 185–194.

Statistics of the fisheries of the Middle Atlantic States, by C. H. Townsend. Report for 1900, pp. 195–310.

Statistics of the fisheries of the New England States, by C. H. Townsend. Report for 1900, pp. 311–386.

The hydroids of the Woods Hole region, by C. C. Nutting. Bulletin for 1899, pp. 325–386.

Descriptions of fifteen new species of fishes from the Hawaiian Islands, by Oliver P. Jenkins. Bulletin for 1899, pp. 387–404.

Parasites of fishes of the Woods Hole region, by Edwin Linton. Bulletin for 1899, pp. 405–492.

There have been distributed during the year 1,213 bound and 12,112 pamphlet publications of the Commission.

The Museum of Comparative Zoology, at Cambridge, Mass., has published the following paper, based on investigations of the steamer *Albatross* in 1891:

Bulletin, vol. XXXVI, No. 6, XXVIII, Description of two new lizards of the genus *Anolis* from Cocos and Malpelo islands, by L. Stejneger. November, 1900.

APPROPRIATIONS.

The appropriations made by Congress for conducting the operations of the Commission for the year ending June 30, 1901, were as follows:

Salaries	$232,980
Miscellaneous expenses:	
Administration	12,500
Propagation of food-fishes	170,000
Inquiry respecting food-fishes	22,500
Statistical inquiry	7,500
Maintenance of vessels	35,000
For improvement and enlargement of stations at—	
Green Lake, Me	3,000
Nashua, N. H	2,500
Woods Hole, Mass	2,000
Wytheville, Va	2,500
Edenton, N. C	6,000
Bullochville, Ga	10,000
Erwin, Tenn	5,000
Put-in Bay, Ohio	3,000
Spearfish, S. Dak	3,500
Baker Lake, Washington	5,000
For improving water supply at St. Johnsbury, Vt., station	20,000
For repairing damage from floods at San Marcos, Tex., station	2,000
For establishment of a marine biological station near Beaufort, N. C	12,500
For establishment of a fish-cultural station in West Virginia	25,000
For continuing investigations regarding lobsters and clams	7,500

A report of the expenditure of these amounts will be made to Congress, in accordance with law.

GEORGE M. BOWERS,
Commissioner.

REPORT ON THE PROPAGATION AND DISTRIBUTION OF FOOD-FISHES.

By W. de C. Ravenel, *Assistant in Charge.*

PROPAGATION OF FOOD-FISHES.

The year's work included the propagation of 32 species of fish and 1 crustacean, and resulted in planting 1,173,833,462 fish and eggs in public and private waters. Operations were conducted on the same general lines as in the past, attention being chiefly directed to keeping up the supply of salmon, shad, white-fish, lake trout, lake herring, pike perch, and other fresh-water fishes, in addition to such important species as the cod, flat-fish, and lobster.

On the Pacific coast the propagation of quinnat salmon was conducted at stations located on tributaries of the Sacramento River in California, on the Rogue River in Oregon, tributaries of the Columbia River in Washington and Oregon, and resulted in the collection of over 23,000,000 eggs. Though the run of salmon on the Sacramento was above the average, the number reaching the headwaters and entering McCloud River and Battle Creek at the points where the stations were located was small. At Baird station 2,139,000 eggs were secured, and at Battle Creek 3,520,000. The fry hatched from these were held for several months and fed before they were planted. On the Rogue River 3,303,000 eggs were secured, from which 1,850,000 young fish were planted at the headwaters of the river and 1,000,000 near its mouth, at Wedderburn. When liberated they were from 2 to 3 inches long, having been fed for several months on canned salmon. For the purpose of maintaining the supply in the Columbia River Basin stations were operated on the Little and Big White Salmon rivers, in Washington, and on the Clackamas River, near Oregon City, Oreg., the work at these points resulting in the collection of more than 14,000,000 eggs and the planting of 10,500,000 young fish between Portland, Oreg., and the Cascades.

At the request of the New Zealand Government, a shipment of 500,000 quinnat-salmon eggs was sent to Littleton, New Zealand, under the care of Mr. G. H. Lambson, superintendent of Baird station. Though the eggs were en route 31 days, and were carried over 7,000 miles, they reached their destination with a loss of only 57,500.

The station at Baker Lake, Washington, was operated as heretofore for maintaining the supply of blueback salmon, which is of great importance commercially on Puget Sound. The run of fish reaching Baker Lake was very small, and owing to the washing away of barriers which had been erected to stop their ascent, only 4,171,000 eggs were secured. From these 3,834,000 fry were hatched and released in Skagit River and Lake. An effort was also made to propagate silver salmon at this station and on the Rogue River, but with slight success.

Very encouraging reports have been received from time to time relative to the successful introduction of steelhead trout in the Great Lakes and other eastern waters, hence all the eggs of this species collected at Elk Creek, a tributary of the Rogue River, were sent to eastern stations, except 65,000, which were hatched and planted in local waters.

The usual arrangements were made during the summer for the collection of lake-trout eggs on Lakes Superior and Michigan by the superintendents of the Michigan and Minnesota stations. The field embraced Port Arthur and Rossport, Ontario, Grand Portage, Minn., Isle Royale, Ontonagon, and other points in Michigan, and yielded 11,900,000 eggs. On Lake Michigan only 200,000 were secured prior to the close of the fishing season; but acting under authority of laws passed by the Michigan legislature, which permit the capture of fish during the closed season for the purposes of artificial propagation, 10,500,000 were collected between November 12 and 28 at Beaver Island from tugs fished by two commercial fishermen. This work was done by the superintendent of the Northville station, under direction of the State fish and game warden and his deputies. The total collection for the season amounted to 22,400,000, from which 19,000,000 fry were hatched and planted in the waters of the Great Lakes.

In addition to collecting white-fish eggs as usual from commercial fishermen, arrangements were made for penning large numbers on the Detroit River and at several points on Lake Erie. The work proved very satisfactory, the Detroit River yielding 203,560,000 eggs and Lake Erie 194,234,000, making a total of 397,794,000. Large consignments were sent to the hatcheries on Lakes Superior and Ontario, with the view to keeping up the supply of this important fish in those waters. The total plants of white-fish fry in all the lakes amounted to 326,106,000.

Great interest having been manifested in the propagation of lake herring, plans were made for extensive operations, but owing to the severity of the weather only 61,000,000 were obtained.

For the purpose of keeping up the supply of pike perch in the Great Lakes and stocking interior waters in the States bordering on them, steps were taken early in April to collect eggs on Lake Erie and on the Missisquoi River, Vermont, a tributary of Lake Champlain. On Lake Erie the season opened propitiously early in April, but violent storms occurred soon after, which not only wrecked the fishing gear,

but roiled the water and drove the fish from the spawning-grounds, so that the season was well advanced before many eggs were obtained. By the close of April 341,000,000 had been taken at the Put-in Bay station. Of these, 10,000,000 were sent to the Missouri commission and 32,000,000 to the Michigan commission; the balance were hatched, producing 160,087,000 fry. Cooperating with the Vermont commission, 160,375,000 pike-perch eggs were collected on the Missisquoi River during April. These were hatched and the fry were planted in May, making a total of 240,887,000 fry planted by the Commission.

At the close of the pike-perch season the propagation of sturgeon was taken up on Lake Champlain, and more than a million eggs were collected. Owing to a sudden change in the temperature and other unavoidable causes only 20,000 fry were hatched and planted, but the experience gained will undoubtedly enable the Commission to conduct on a larger scale in future the propagation of this important fish, which is fast disappearing from the waters of this country.

In October the U. S. Fish Commission steamer *Grampus* was engaged in collecting brood cod for Woods Hole station, and secured 2,933, ranging from 6 to 20 pounds in weight, which were placed in pounds and held until ripe. A considerable number died from natural causes, but more than 2,000 were tagged and liberated, and at the close of the year 46 had been reported as captured along the coast, many of them at long distances from the station.

The collecting stations at Kittery Point and Plymouth were opened in November. The weather for the first two months was very favorable for the work, but the catch of fish was unprecedentedly poor, and after the 1st of January, when fish became abundant, the weather was so rough that for days fishing was impracticable and the collections were therefore small. The brood fish at Woods Hole yielded 140,754,000 eggs, and these, with the eggs obtained at the two field stations, made an aggregate of 311,000,000. They were hatched at the Gloucester and Woods Hole stations, and the fry, numbering 202,871,000, were planted on the spawning-grounds along the coast from Kittery to Block Island.

At the close of the cod work at Woods Hole the propagation of flat-fish (winter flounder) was taken up, and as a result of the season's operations over 44,000,000 fry were liberated south of Cape Cod.

Early in the spring arrangements were perfected for securing the egg-bearing lobsters captured by fishermen along the coast from Maine to Connecticut. The schooner *Grampus*, assisted by a steam smack, made frequent trips along the Maine coast, visiting not only the large dealers at the important fishing centers, but also those on the outlying islands. Agents were stationed at Kittery, Marblehead, Boston, Plymouth, Block Island, and other points, but although the catch of lobsters was greater in Maine than in the previous year, the work was less satisfactory than then. At Woods Hole only 18,262,000 eggs were secured, and at Gloucester 51,213,000, a total of 69,475,000, which

yielded a little over 60,000,000 fry, as against 77,000,000 the previous year. As indicated by the number of egg-bearing lobsters purchased, the decline in this important fishery has been greatest south of Cape Cod, and especially in the vicinity of Woods Hole.

The establishment of the station at Edenton, N. C., permitted the commencement of shad work in March. The run of shad on the Albemarle Sound was not only very large, but the herring catch fell below the average, and as the temperature was slightly below normal the season in that region proved most successful, over 75,000,000 eggs being collected between March 29 and May 15. On the Potomac River conditions were exceedingly unfavorable. The weather was unusually cold and the catch of shad on the upper river very small, and at the end of the season only 33,321,000 eggs had been secured at Bryan Point station. Practically the same conditions existed on the Susquehanna River, and although work was pushed energetically at Battery station the total collections for the season amounted to only 61,000,000. On the Delaware River, where the steamer *Fish Hawk* had been stationed as a floating hatchery, the weather was cool and the catch of fish very large. The season lasted from May 6 to June 13, during which time over 115,000,000 eggs were secured, the largest number ever taken on that river. The total collections for the year amounted to 284,829,000, and the output of fry aggregated 193,287,000, nearly 50,000,000 less than that of the previous year.

The propagation of the basses and other fish suitable for stocking inland waters was conducted as usual. The results were gratifying, particularly in the increased number of black-spotted trout (*Salmo clarkii*) and brook trout (*Salvelinus fontinalis*) handled.

The Commission operated the following 37 stations and substations, and the work at each is reviewed in detail in the abstracts from the reports of the different superintendents:

Green Lake, Maine.
Craig Brook, Maine.
Grand Lake Stream, Maine.
St. Johnsbury, Vermont.
Nashua, New Hampshire.
Gloucester, Massachusetts.
Woods Hole, Massachusetts.
Cape Vincent, New York.
Steamer *Fish Hawk* (Delaware River).
Battery Station, Maryland.
Fish Lakes, Washington, D. C.
Central Station, Washington, D. C.
Bryan Point, Maryland.
Edenton, North Carolina.
Wytheville, Virginia.
Erwin, Tennessee.
Cold Springs, Georgia.
Put-in Bay, Ohio.
Northville, Michigan.
Detroit, Michigan.
Alpena, Michigan.
Sault Ste. Marie, Michigan.
Duluth, Minnesota.
Quincy, Illinois.
Manchester, Iowa.
Bellevue, Iowa.
Neosho, Missouri.
San Marcos, Texas.
Leadville, Colorado.
Spearfish, South Dakota.
Bozeman, Montana.
Baird, California.
Battle Creek, California.
Clackamas, Oregon.
Rogue River, Oregon.
Little White Salmon River, Washington.
Baker Lake, Washington.

RESULTS OF FISH-CULTURE.

Reports from various parts of the country have been received with reference to the capture of rainbow trout in streams stocked by the Commission, one of the most interesting being a letter from Mr. P. H. Rowell, of Ennis, Ellis County, Tex., in which he states that a 10-pound rainbow trout was taken from a lake near the city, as a result of plants made by the Commission in February, 1899. He also reported that large numbers of small fish had been seen, showing that this species has been successfully introduced even in that latitude. According to a report received from Manton, Mich., a rainbow trout was captured on May 31, measuring 31 inches in length, 15 inches around, and weighing 12¾ pounds.

A catch of rainbow trout from Laurel River, Virginia.

The above reproduction of a photograph is illustrative of the successful introduction of this game fish in Laurel River, Virginia. These specimens were captured near Damascus by Mr. Benjamin T. Clark, of Abingdon, Va.

Although the Commission, in cooperation with the Pennsylvania commission, has liberated annually considerable numbers of Atlantic salmon fry in the upper waters of the Delaware River, and a number of salmon are caught each spring in this river by men fishing with shad and gill nets, it is a matter of regret that there has yet been no regularly established run of this important species reported. During the spring of 1900 seven specimens, weighing 10 pounds and upward, were caught near Gloucester, N. J., in the vicinity of the steamer *Fish Hawk*—one of 10 pounds weight being taken in a gill net almost

under the stern of the vessel. In 1901 nine salmon, ranging from 8 to 15 pounds, were captured at Howells Cove Fishery, the three largest weighing 11, 13, and 14½ pounds. As a result of an investigation made by the Commission, based on a newspaper article, it was learned that three salmon had been taken from the Delaware River at Newcastle. These were captured in gill nets; they weighed 9½, 10, and 11 pounds, and sold for 45 cents per pound. The capture of one weighing 10½ pounds, near Trenton, was also verified.

Favorable reports continue to come in from Lake Superior and the inland waters of Minnesota, regarding the adaptability of the steelhead trout for that section. Mr. H. H. Marks, of the Michigan Fish Commission, forwarded in June, 1901, a steelhead taken from a pound net near Salt Point, Lake Superior, which measured 30 inches in length. Mr. R. C. Mason, writing from Winona, Minn., reports that they are well adapted to Lake La Belle, and that, as a result of six cans of fry planted in 1898, specimens weighing 2½ pounds have been taken by the anglers. The steelhead is not only an excellent game fish, but its food qualities are highly regarded, as indicated by numerous letters received from residents of Pickwick, Minn. In Vermont the fish are apparently so well established in Willoughby Lake that arrangements were made to operate a field station in March, but only two ripe fish were captured; these yielded 2,000 eggs.

Following is an interesting extract from a letter written by the superintendent of the St. Johnsbury station, with reference to the presence of lake trout in Big Averill Pond, Vermont:

> Four years ago we planted some lake trout in Big Averill Pond and have sent some there every year since. This year they are getting very good fishing in that lake, catching most of the fish by trolling. The 4-year-old trout weigh 3½ pounds, the 3-year-olds 2¾ pounds, the 2-year-olds 1½ pounds, and the 1-year-olds are 11 inches long; the weight was not taken, as those under 12 inches in length are not kept. I went out for a couple of hours Sunday morning and caught one 3-year-old, two 2-year-olds, and one 1-year-old laker. I give you this information to let you know another lake where good results have followed the planting of artificially hatched trout. No lake trout ever lived in this lake until those introduced by the Commission. From Big Averill I went to Little Averill to catch some of the golden trout. I succeeded in catching seven with hook and line, ranging from a yearling to 3 pounds in weight. I had a gill net put in one night, but caught only three fish in it—one landlocked salmon and two golden trout. The salmon is one which must have been put in by the Commission three years ago. Below the outlet of Little Averill, and between Big and Little Averill ponds, I fished about fifteen minutes and caught one yearling and one 2-year-old landlocked salmon. There is every indication that the series of lakes known as Big and Little Averill and Little Leach will make a good field station in the early future. They are all easily accessible and can be operated from one central field station. They contain brook trout, lake trout, golden trout, and landlocked salmon.

Mr. H. B. Handy, under date of January 20, 1901, refers to the successful stocking of Nine Mile Pond (which is 9 miles in circumference), near Centerville, Mass., with black bass, under very unfavorable conditions, several years ago. A few hundred fish from 2 to 4 inches

long were placed in this pond through a hole cut in ice. As the pond was thoroughly stocked with pickerel and perch, his neighbors were very skeptical of ever seeing any of the bass; but they now catch large numbers of black bass, some weighing as high as 3½ pounds.

INSPECTION OF STATIONS.

During the month of December the Fish Commission stations at Neosho, Mo., and San Marcos, Tex., were inspected by the assistant in charge of the division of fish-culture, as a result of urgent recommendations by the superintendents that arrangements be made for an increased water supply and additional property for the construction of more ponds for the propagation of black bass.

After carefully considering the condition of affairs at Neosho, it was found that not only was a greater supply of water essential, but that the hatchery would have to be rebuilt and enlarged and that land should be acquired for the construction of bass ponds, in order to increase the output of this important species. Preliminary arrangements were made for obtaining additional water from the City Water Works Company, and an option was secured on property adjacent to the Government lands. An estimate was submitted to Congress for a special appropriation of $7,500 to cover the cost of the improvements referred to, which was favorably acted upon. The condition of this station was excellent, reflecting credit on the superintendent and his assistants.

No fish-cultural work was in progress at San Marcos when visited. The ponds were being drained, preparatory to cleaning and restocking for the breeding season, which usually commences in February. The general appearance of the station, including the buildings, was excellent, and bore evidence of careful and judicious management. The artesian well was supplying only a fair amount of water, but as the majority of the ponds are now supplied by a ram and by a 27-foot overshot wheel, operated by the San Marcos River. this was not regarded as of great importance.

The demands for fish of all kinds in the State of Texas are constantly increasing, and as the present output is all that could be expected from the ponds in use, it was recommended that a special appropriation be made for securing more water and constructing ponds on lands belonging to the Government. In providing the water supply it was apparently necessary to acquire property on the river front for the erection of overshot wheels or other appliances for lifting water from the San Marcos River, and an option was secured on a desirable piece of property and an estimate submitted to Congress for the funds necessary in carrying out the recommendations referred to. This resulted in obtaining a special appropriation of $8,000.

STATION REPORTS.

Green Lake Station, Maine (E. E. Race, Superintendent).

The following are the principal improvements at the station during the past fiscal year: The dam at Rocky Pond has been thoroughly overhauled, repaired, and raised 5 feet; the eastern and western wings lengthened 82 feet, making the dam 310 feet long and giving a 9-foot head of water at the inlet of the main supply flume, thereby nearly doubling the station water supply. The main supply flume has been put in good condition, 485 feet of it being rebuilt, and 360 new yokes put on. A coal shed has been constructed at Maddocks Landing for the storage of coal for the steamer *Senator*, and a number of minor repairs and improvements made to the cottages of the foreman and superintendent. The cottages for the laborers at the station have been completed and two of the men provided with comfortable homes for their families. Changes have been made in the water supply and sewer systems, the station force rendering material assistance in all this work when not engaged in caring for the stock of fish on hand.

The landlocked salmon on hand at the beginning of the year were held until September, when 177,899 were distributed to applicants in Maine and other New England States.

During the summer and fall the usual arrangements were made for establishing collecting stations at various points. As reports indicated that large numbers of brook trout and landlocked salmon could be secured in Lakes Onawa and Sebec, in Piscataquis County, the superintendent investigated those waters and established a station at the head of Lake Onawa. Two pound nets and a slat trap were fished until November 24, but only 21 brook trout and 16 salmon were captured. All the lakes and streams within a radius of 10 miles were examined, but without result. In October a trap was placed between Lake Onawa and Sebec Lake on Ship Pond Stream, but though large numbers of salmon were found above and below the Cowyard Falls, only 105 were captured, 4 of which were females.

The work resulted in the collection of 6,000 brook-trout eggs and 15,000 salmon eggs, which were transferred to Green Lake.

The following table shows the fish and eggs obtained at the stations operated in connection with Green Lake.

Point of collection.	Brook and lake trout.		Landlocked salmon.	
	No. of fish.	Eggs obtained.	No. of fish.	Eggs obtained.
Winkempaugh Brook (Branch Pond)	84	65,500	75	108,000
Patten Pond	162	74,000	10	14,500
Green Lake	5	2,000	96	160,500
Cold Stream Pond	386	*717,000	25	38,000
Lake Onawa	21	6,000	121	15,000
Total	658	864,500	327	336,000

* Lake-trout eggs.

Of the lake-trout eggs, 358,500 were turned over to the Maine Fish Commission at Enfield. The balance were shipped to Green Lake and produced 329,827 fry, which were planted during the spring.

In addition to the 147,500 brook-trout eggs collected, 400,000 purchased from dealers in Massachusetts were delivered at the station in excellent condition. They hatched in March and were planted during April, May, and June, the losses being comparatively light.

Of the 336,000 landlocked-salmon eggs, 15,855 were transferred to the Maine Fish Commission. The balance yielded 280,231 fry, which, instead of being held until fall, were planted in June, owing to the bursting of the reservoir dam early in that month.

During the freshets in April there was a surface wash around the western wing of the dam, but this was filled with gravel and the embankment raised, making it impossible for the water to pass around the extreme end. It was noticed shortly afterwards, however, that the old wing had gone to the south about 5 inches, and a close examination showed that the old timbers pressed hard against the bolts in the ledge, causing this sag. The water at the time was running over the dam between the flush boards 6 inches, but the log gate was opened and the water reduced 3 feet. The pond was never full again, and the head was 14 inches less when the dam gave way. A careful examination has since shown that the new wing gave way at a point where it had been connected with the old dam, which was apparently the strongest spot in the whole structure. The piling put in to secure the wing rested on hard clay bottom, but $2\frac{1}{2}$ feet under the ends of these pilings a layer of quicksand extended directly under the wing for 15 or 20 feet. The water had probably worked its way underneath the foundation and the quicksand washed out, causing the wing to collapse. As the supply flume was carried away for a considerable distance, the water supply to the station was completely cut off, which necessitated the planting not only of all the brook trout and landlocked salmon fingerlings, but also the adult fish held in the ponds and reservoirs.

Craig Brook Station, Maine (Charles G. Atkins, Superintendent).

The Atlantic salmon received, as usual, the greater share of attention, this being the most important feature of the work at the station. The 194,572 on hand at the beginning of the year were carried until fall and distributed with very slight loss. The food for all fishes at the station, including the older stock of nearly 5,000, consisted almost wholly of hog-plucks purchased from an abattoir in the vicinity of Boston. Of the various kinds of food 17,231 pounds were consumed, costing $212.30, including transportation.

In addition to the yearlings on hand at the beginning of the year, 210 adult salmon were confined at Dead Brook for breeding purposes. This lot spawned in October, but by that time they had been reduced to 150, of which 66 were males. They yielded 665,000 eggs, 205,000 of

which were distributed and 354,977 hatched. Of the fry, 10,000 were distributed in June and 300,295 remained on hand at the close of the year, to be reared to the yearling stage for distribution in the late fall.

At the beginning of the year preparations for the capture of salmon at Hunt Logan, Mattagamon, were well advanced. The leader of the weir was thrown across the river so as to intercept the ascent of salmon by July 3, and a few days later salmon were observed in the outer pond. A number of other improvements were in progress, but a heavy rainfall brought on an unprecedented freshet for July. On July 18 the main rack was swept away, liberating the fish inclosed by it and disabling the weir for a time. By the time the repairs were made it was apparent that all of the fish had escaped during the flood. The rest of the season was devoted to improving the weir and inclosure and in preparing for another attempt in 1901. In April work was again commenced on the weir, and by the end of the year the river was practically closed. The rack has been much improved, and it is believed will be an effectual barrier to the ascent of salmon.

The landlocked salmon held at Grand Lake Stream for distribution in the fall were seriously reduced in numbers in July by a disease which made its appearance late in June. The cause of this disease is unknown, but it is thought to have been due to the presence of large quantities of hemlock bark in the canal. This bark with some other rubbish was removed from the water supply early in July, and no further trouble was experienced. From June 21 to 29 inclusive the temperature of the water reached 69° or 70° each afternoon, and it is possible that this long-continued warm weather may have proven too much for the young fish, though they subsequently stood a temperature of 75° or more without injury. This was later in the season, however, and they had become older and stronger. It was estimated that 53,715 fry were in the troughs on July 1, but this estimate was evidently too large, as the count in October showed only 33,862. Of these, 8,000 were liberated in Sysladobsis Lake, a tributary of Grand Lake, and the others were deposited in Grand Lake and Grand Lake Stream, near the natural spawning-grounds. During the last days of October the trap was put in condition for the capture of adult salmon, and on November 21, when fishing operations ceased, 819 salmon—322 males and 497 females—had been caught. From these, 409,290 eggs were obtained, an average of about 847 eggs to each female. This, though a very small average, was better than that of the preceding year, which amounted to only about 700. The eggs were carried through the winter until ready for shipment in March with a total loss of 95,000, leaving on hand 314,200 good eggs. Half of these were transferred to Craig Brook for distribution to other stations and private applicants; the remainder were retained at Grand Lake Stream and hatched practically without loss; 76,692 of the fry were planted during June, leaving on hand 75,201 for rearing to the yearling stage.

Of the eggs sent to Craig Brook, 130,000 were transferred to other points and 25,000 were hatched at the station. On June 30 there remained on hand 24,194 fingerlings.

From the brood Scotch sea trout 108,940 eggs were collected in October and November. Of these, 12,000 were shipped, and the balance produced 42,010 fry, but they were of inferior quality and at the end of the year only 8,902 remained. It is noticeable that Scotch sea trout have deteriorated greatly since their introduction at this station, and few, if any, healthy eggs are obtained from them, though in the early experiments they appeared to be exceptionally strong and thrifty. Whether this is due to deprivation of sea water and sea food, to which in a state of nature they have access, is a question yet unsolved.

The following table shows the stock of fish of all kinds on hand June 30, 1901:

Species.	Calendar year in which fish were hatched.					Wild fish inclosed.
	1901.	1900.	1899.	1898.	1897.	
Atlantic salmon	300,295	.....	411	.....	.....	238
Quinnat salmon	.....	.....	.....	.....	51	.....
Landlocked salmon	24,229	100	969	727	.....	.....
Scotch sea trout	8,902	.....	47	.....	177	.....
Steelhead trout	419	150	942	.....	124	.....
Brook trout	2,137	.....	.....	.....	.....	.....
Rainbow trout	3,768	1,395	38	.....	.....	.....
Total	339,750	1,645	2,407	727	369	238

At Grand Lake Stream, landlocked salmon, 72,312.

ST. JOHNSBURY STATION, VERMONT (J. W. TITCOMB, SUPERINTENDENT).

During the summer preparations were made for conducting field stations in Canada for collecting brook-trout eggs, and at Lakes Mitchell and Dunmore, in Vermont, for brook and lake trout eggs respectively. Prior to undertaking work in Canada the superintendent visited the preserve of the St. Bernard Club, between September 14 and 24, when he made a hurried inspection of the so-called Red Lakes, Lakes Saccacomi, Willie, Tumble, St. Bernard, Big and Little Thunder, Papineau, and Madam Henry. Trout were abundant in these waters, and there were indications that some of them would spawn in October in the tributary streams. Arrangements were made with Mr. C. H. Simpson to build a new hatchery at Bark River, which was placed under the direction of the superintendent.

Active operations were commenced in October, and the probable spawning-grounds on all the lakes were carefully watched, fish being frequently caught and examined. Very rough and windy weather prevailed throughout November, but inspections were made at night by jack-light when it was impossible to inspect by daylight.

In spite of very persistent work, the station was closed on December 1, a total failure so far as the collection of eggs was concerned. From the data obtained and further investigations by the superin-

tendent from the 7th to the 12th of December the following facts were developed: That the trout in the various lakes controlled by the St. Bernard Club do not ascend the streams to spawn, but spawn around the shores of the lakes; that while the fish in some of the smaller lakes may spawn as early as the latter part of October, the principal period of spawning extends from November 15 late into January, after the waters over the beds are covered with ice; furthermore, that it would be unprofitable to collect eggs on these lakes by catching the fish after they have arrived on the spawning-beds; that if the work is to be conducted there, the fish should be caught before the cold windy weather of October and November sets in, and retained in pens to ripen; that there is a great abundance of trout and a tremendous waste of eggs in the natural process of reproduction.

At Lake Willie the trout spawned November 16 to 30, after the lake was frozen over, but before the ice was sufficiently strong to bear a man. Here one bed, a foot in diameter, was watched for half a day, and 26 male trout, 8 egg-bearing females, and 14 spent females were caught from it. Most of these fish were there to eat eggs, as was seen on opening them.

At the request of Mr. W. H. Parker, the manager of the Laurentian Club, Lac La Peche, Province of Quebec, the superintendent, in June, made a reconnoitering trip of the preserves controlled by the Laurentian and Shawenegan clubs, in Canada. It is recommended that another attempt be made to collect eggs of the brook trout and the so-called red trout, in cooperation with the clubs referred to. The red trout inhabits four lakes in the township of St. Alexis Des Monts, county of Maskinonge, Province of Quebec, and though it is impossible to judge as to their abundance, except during the spawning season, it is believed that their eggs can be successfully collected. The spawning season is from about the 20th to the 31st of December. This trout averages about the same in size as the brook trout, being about 9 inches long when matured. The largest of which the superintendent had reliable information weighed 4 pounds, though some have been reported weighing 7 pounds. As food they are excellent, the flesh being red in color and not dry, more like the salmon than the speckled trout. They are usually caught by "still fishing," with minnows or angleworms, though there are authentic reports that two have been taken on Lake Saccacomi with the fly and one by trolling.

The field station for the collection of lake-trout eggs at Lake Dunmore, Vermont, was opened October 19, and from October 22 fishing was continuously conducted until November 6; 344 males and 106 females were captured, which produced 162,000 eggs; 158,500 eggs were transferred to St. Johnsbury, where 125,400 fry were hatched from them.

At Lake Mitchell operations extended from August 2 to December 20, during which period 1,789 trout were caught. Of these 909 were

females and yielded 503,000 eggs, of which 473,200 were eyed. All except 120,000, which were shipped to other points, were transferred to St. Johnsbury, where they yielded 255,000 fry.

A lot of 30,000 eggs was also derived from the Wells River Fish and Game Club, and these, together with 10,000 eggs obtained from the brood fish at the station, yielded 9,500 fry. In addition to these, 25,000 domesticated trout eggs were received from Mr. H. F. Hurlbut, East Freetown, Mass., in exchange for eggs of the wild trout, and 290,000 eggs were purchased from him. The following shipments were received from other stations: 20,000 landlocked-salmon eggs from Craig Brook, Maine; from Rogue River, Oregon, 46,000 eggs of the steelhead trout.

The domesticated eggs above referred to, aggregating 315,000, were very disappointing, and as compared with the results secured from eggs taken from wild fish, it would seem that wild-trout eggs are much better in quality than the domesticated.

The trout on hand at the beginning of the year and those hatched during the spring were distributed as indicated in the details of distribution.

In March arrangements were made to collect steelhead-trout eggs at Willoughby Lake. A small trap net was set at the mouth of the principal stream, and a larger trap on a bar just off the mouth of the brook. Much difficulty was experienced in keeping this trap free of sawdust and mill refuse, and no fish were caught until May 1, when several steelheads were taken by fishermen trolling on the lake. Several ripe males entered the trap net between May 9 and 29. On May 19 one ripe female was secured, which yielded 1,778 eggs. These were shipped green by express to St. Johnsbury, with a loss of only 23. The fry hatched from them were apparently strong and healthy.

Though only a few eggs were obtained this year, there is no doubt that in a few years large numbers of steelhead-trout eggs can be collected in Willoughby Lake if the difficulty of capturing the fish can be overcome. It appears from Mr. Cobb's observations that steelheads probably spawn on the shoals of the lake, not entering the smaller streams.

The fish on hand at the close of the year are shown in the following table:

Species.	Calendar year in which fish were hatched.				
	1901.	1900.	1899.	1898.	1897.
Steelhead trout	38,984		236	39	6
Rainbow trout	1,000	402	77		182
Brook trout	14,473		467		
Grayling			45		
Brook and lake hybrids				4	
Rainbow and steelhead hybrids		261			
Lake trout	3,814				
Landlocked salmon	18,647				

NASHUA STATION, NEW HAMPSHIRE (W. F. HUBBARD, SUPERINTENDENT).

The superintendent visited Greenough and Diamond ponds and Connecticut lakes, in the northern part of New Hampshire, for the purpose of securing a site for the collection of brook-trout eggs, and selected Diamond Pond as the most favorable place, and during the latter part of September two of the employees of the station were detailed to that point. A rough shanty was erected and the necessary troughs provided. The fishing was done with hook and line and with gill nets, and continued until November 30. During this time 909 trout were captured, of which 357 females produced eggs. The first were collected on October 12 and the last on November 30, the number being estimated at 140,000. At the close of operations the men returned to the station, leaving the eggs in charge of a watchman until the last of January, when it was found that they numbered only 15,120. The loss was attributed to the carelessness and ignorance of the watchman.

From the brood fish at the station 100,000 eggs were collected between October 13 and December 20. In January 500,000 brook-trout eggs were purchased from dealers in Massachusetts, and an assignment of 50,000 was received from the New Hampshire commission, also some landlocked-salmon and golden-trout eggs, which will be hatched and planted under their direction.

A fair percentage of all the eggs received hatched, but the fry from those purchased and from those belonging to the New Hampshire commission suffered very heavy losses when about 4 or 5 weeks old. As fry from eggs taken at the station and from Diamond Pond were not similarly affected it is believed that the eggs were of poor quality.

During the spring 191,000 fry were planted in local waters, and there remained on hand at the end of the year the following stock:

Species.	Calendar year in which fish were hatched.				
	1901.	1900.	1899.	1898.	1897.
Brook trout	63,810	5,295			110
Steelhead trout			6		
Rainbow trout				55	
Landlocked salmon	46,100			63	
Dublin trout	75			59	
Grayling		48			
Golden trout	850				
Total	110,835	5,343	6	177	110

In the early summer the employees at the station were occupied in making a number of improvements in the superintendent's cottage, and, assisted by a crew of temporary men, a number of new nursery ponds, 14 feet long by 8 feet wide, were constructed, and a storm ditch 3 feet wide and 2 feet deep was built for the purpose of protecting the ponds from freshets caused by surface water during the wet season. Since its construction it has several times prevented the ponds and hatchery from being flooded, which would have caused the loss

of most of the stock at the station. Wells were driven in the 14 new ponds and in a number of the old ones. These varied in depth from 14 feet to 60 feet, and a flow of water was obtained in all except those placed in Ponds A and F and the supply ditch, which were all 60 feet deep.

GLOUCESTER STATION, MASS. (C. G. CORLISS, SUPERINTENDENT).

Besides the usual work of overhauling and repairing the cod-hatching apparatus, the station force was occupied during the summer and fall in constructing a pump-room 16 by 12 feet, adjoining the fire-room, and installing a new Blake pump of 600 gallons per minute capacity. New floors were laid throughout the building, and a number of other improvements were made, including the rearrangement of the suction and supply pipes.

In November the usual arrangements were made for collecting cod eggs at Kittery Point, and a force of spawn-takers, under Captain Hahn, reported there on November 19. The weather during the first two months was generally good, and there was little difficulty in securing boats for the spawn-takers, but the fishing was a failure, especially during the early part of the season, so that the daily receipts of eggs were rarely as large as expected, considering the number of spawn-takers employed and extent of territory covered. The spawn-takers were untiring in their efforts, and the field of operations covered the fishing-grounds between Gloucester and Marblehead, Mass., in addition to Ipswich Bay.

The first eggs were received from Kittery Point on November 24 and the last on March 25, the collections amounting to 98,546,000. Besides these, 49,036,000 were transferred from Plymouth and 7,842,000 from Woods Hole, a total of 155,424,000. From these eggs 100,466,000 fry were hatched and planted on the natural spawning-grounds from Ipswich Bay to Boston.

In view of the uncertainty of collecting a large number of cod eggs at Kittery Point and Plymouth, it is urged that steps be taken to provide a suitable inclosure near the station where live brood cod can be held. It is believed that a structure of this kind can be built for about $2,000.

Early in April preparatory steps were taken to collect egg-bearing lobsters from fishermen operating in the vicinity of Gloucester, Beverly, Boston, and Cohasset, Mass., and Kittery Point, Me., collectors being stationed at Kittery, Boston, and Beverly. The schooner *Grampus*, assisted by a steam lobster-smack, made collections along the Maine coast from Portland to Rockland. This work was delayed by the stormy weather prevailing during the entire month of April and the early part of May. Heavy easterly winds, accompanied by rainfall, were of almost daily occurrence, causing a strong current along the coast and practically putting a stop to lobster fishing during this period. The first eggs were not received until May 11, and from

this time the work was pushed vigorously. The collections from the fishermen at all points compared favorably with other years, several places showing an increase, but the receipts from the large dealers in Boston and Portland fell off, although more lobsters were handled by these parties than during any other season for the past decade. The probable reason for this was that a large percentage of the lobsters handled by the dealers at those points came from Canadian waters, where strict inspection laws prevent the shipment of egg lobsters.

During the season 4,169 egg lobsters were collected, from which 51,213,000 eggs were obtained. The following table shows the number of egg lobsters and eggs received from the collecting fields:

Field.	Lobsters.	Eggs.
Maine coast, schooner Grampus	1,600	19,467,000
Boston, Cohasset, and vicinity	896	11,552,000
Kittery Point, Me., and vicinity	930	10,543,000
Gloucester, Beverly, and vicinity	743	9,651,000
Total	4,169	51,213,000

Of the 47,270,000 fry hatched, 15,000,000 were planted in Maine waters, and 32,270,000 were distributed in Massachusetts from Lanesville to Cohasset. Of the fry sent to the Maine coast 4,500,000 were taken on the schooner *Grampus* and 10,500,000 were shipped by rail to Portland, where they were transferred to the schooner and planted at points along the coast, selected after consultation with Hon. A. R. Nickerson, commissioner of sea and shore fisheries of the State.

The adult lobsters were as usual released in the localities from which they were secured. The continued decrease in the collection of egg lobsters during the past two years makes it evident that if the work is to be put on a permanent basis arrangements must be made for impounding egg lobsters during the fall and holding them until the eggs are ripe.

Woods Hole Station, Mass. (E. F. Locke, Superintendent).

During the summer the wharf was completed, some necessary repairs were made to the residence and launches, and a new dynamo was substituted in place of the old machine, which had become too small for the station, owing to the development of the biological work. The laboratory was kept open all summer, under the direction of Dr. H. C. Bumpus.

In accordance with the usual custom, the schooner *Grampus* began the collection of brood cod on October 1, and obtained 2,933 fish, ranging from 6 to 20 pounds in weight, by the 9th of November, when the work was discontinued and the crew sent to Kittery Point. The stock was further increased by the purchase of 332 fish from commercial fishermen, making a total of 3,265. Of these, 1,170 died from natural causes and 692 were killed by anchor frost. The others were

tagged and released after the eggs had been taken, and at the close of the year 46 had been reported captured, many of them at long distances from the station.

The collecting station at Plymouth was opened in November, work at that point being under the direction of Mr. R. N. Veeder. The spawn-takers, four in number, commenced work December 1, and on December 3 collected 3,000,000 eggs, which were shipped to Woods Hole. On account of the scarcity of fish, very few vessels operated in the vicinity of Plymouth early in the season, and later, when they became plentiful, the weather was so unfavorable and the sea so rough that fishermen could not get to the fishing-grounds. In addition to this, for three weeks during February the harbor was closed by ice and the steam launch frozen in, but notwithstanding all these difficulties 71,713,000 eggs were collected, 52,068,000 being sent to Gloucester and the remaining 19,645,000 to Woods Hole.

The brood fish commenced spawning November 14 and yielded 140,754,000 eggs, bringing the total handled at the station to 160,399,000. From these 102,405,000 fry were hatched and planted on the spawning-grounds in the vicinity of the station.

Early in January three fyke nets were set in Woods Hole for the purpose of collecting flat-fish, and about January 22 a number were placed in Waquoit Bay. This work was seriously interfered with by an exceedingly cold wave, which swept over New England early in February, lasting nearly the entire month and closing the harbors and bays with ice, so that it was impossible to reach the nets. As a result of the work 63 ripe fish were taken at Woods Hole and 107 at Waquoit Bay, but 42 died before spawning. Between January 28 and the 13th of April 53,099,000 eggs were collected, from which 44,230,000 fry were hatched. The methods followed in handling the brood fish were similar to those employed the previous season, and the results were equally good.

Although every effort was made to increase the lobster work, the results, as indicated by the number of eggs collected, were for several reasons the poorest that have been secured at this station. Arrangements were made early in March to collect egg lobsters at Plymouth and Scituate, Mass., but the receipts from those points were small, only 10 being secured from the fishermen in the immediate vicinity of the station, though large numbers of fish had been furnished them during the winter for lobster bait. An effort was also made to collect egg lobsters in Connecticut waters, a schooner being chartered for this purpose, but the returns were so poor that the work was abandoned at the end of May. Owing to a change in the laws of Rhode Island it was late in the season before arrangements could be perfected for the collection of eggs in that State, and it was only done then through the courtesy of the commissioners of inland fisheries, Dr. A. D. Mead and Mr. Henry T. Root.

The following table shows the receipts from the different sections for 1900 and 1901, and sets forth clearly the marked decrease this year at all points, especially in the vicinity of the station and around Buzzards Bay:

Field of collection.	1900.	1901.
Noank and Stonington, Conn., and Block Island, R. I	2,710,000	1,468,000
Woods Hole and vicinity, including Buzzards Bay	7,199,000	2,523,000
Plymouth, Mass	1,348,000	1,181,000
Scituate, Mass	3,827,000	1,772,000
Newport, R. I	13,058,000	11,318,000
Total	28,142,000	18,262,000

The total number of eggs collected was 18,262,000, from which 13,945,000 fry were hatched and planted. Considerable improvement has been made this year in the method of hatching the eggs of the lobster, the McDonald jar with the open top being used in combination with the ordinary glass aquarium, instead of the old Chester jar covered with scrim. A scale similar to that used in white-fish work was devised for the measurement of the eggs, and it was found to be not only more convenient, but fully as accurate as the old method of measuring in a glass graduate.

CAPE VINCENT STATION, N. Y. (LIVINGSTON STONE, SUPERINTENDENT).

A new coal-house has been built during the past year and various minor improvements have been made.

In October 68,000 lake-trout eggs were collected from the local fishermen and 1,500,000 were transferred from the Michigan and Minnesota stations. In January 325,000 brook-trout eggs were purchased from commercial hatcheries in New England, and 21,592,000 white-fish eggs were received from Put-in Bay, Ohio, and 720,000 collected from local fishermen. The eggs were successfully hatched in the spring, producing 1,485,000 lake trout, 275,100 brook trout, and 13,552,000 white-fish, which were distributed as usual.

With a view to the collection of pike-perch and sturgeon eggs in Vermont, the superintendent had a conference with the Vermont fish commissioners, which resulted in an agreement whereby the U. S. Fish Commission was authorized to collect eggs of these fishes in that State, the same to be hatched at Swanton, where a new State hatchery had been erected. The fry resulting from a third of the eggs were to be turned over to the Swanton fish commissioner for distribution in Vermont waters, the other two-thirds to belong to the U. S. Fish Commission.

On March 20, M. A. Mason was detailed from Cape Vincent to fit up the hatchery at Swanton, utilizing the old equipment as far as possible. The hatchery as equipped contained 348 jars, 100 of which were furnished by the Vermont commission, the others by the U. S. Fish Commission. By April 10 the ice had disappeared from the river

and fishing commenced. On the 17th ripe females were caught, and on the 18th the first eggs were collected. The conditions existing at this time were very unusual, as the river water, instead of warming up and increasing in volume, remained stationary in temperature for ten days or more, during which time there was scarcely any perceptible rise or current. Spawning fish were therefore not attracted upstream, and the catch, although large, consisted mostly of males, in some hauls the ratio being 100 males to 1 female. It consequently became necessary to fish seines in Lake Champlain a few miles below the mouth of the river. The seining along the lake shore was quite successful, and as a result of the season's work about 3,500 female pike perch were secured, of which 2,910 produced 160,375,000 eggs, the last being collected on April 30. The methods followed were practically the same as in previous years, though a number of experiments were tried with reference to the fertilization and transportation of eggs. The loss from fungus after the eggs were received at the hatchery was very large. Of those that were eyed, 22,500,000 were transferred to Cape Vincent and 4,000,000 to the Massachusetts Fish Commission. Those sent to Cape Vincent arrived in very bad condition and produced only 13,800,000 fry. At Swanton 23,750,000 fry were hatched and distributed from that point, 16,750,000 being turned over to the Vermont Fish Commission.

At the close of the pike-perch season preparations were commenced for the capture of sturgeon and the collection of their eggs. On the Missisquoi it was planned to place a rack across the river, consisting of wire netting and common seine twine, with a trap in the center, for the purpose of stopping the sturgeon ascending the river, after the manner of stopping salmon on the Pacific coast, but this idea was abandoned, owing to the fact that steamers ply up and down the river during high water in the spring. Pound and trap nets were also tried, but gill nets were finally resorted to, about 30 sturgeon being taken in this manner from various places in the river. These were placed in pens provided for pike perch, but later in a pen built in the river with boards laid horizontally on edge, a space being left between to let water in and out. The fish in the pens were examined daily, and on May 13 a large ripe female was found, which struggled so violently on being taken from the water that the combined efforts of three men could not prevent it from casting its spawn, some of which was thrown 30 feet or more. When finally subdued, the few remaining eggs left in the fish, somewhat less than a quart, were taken in a dry spawning pan. These were mixed with milt and treated in the same general way that pike-perch eggs are. When the eggs were finally separated they were placed in a McDonald hatching jar, such as is used for pike perch. No further trouble from the eggs sticking together was experienced, but they were so heavy that the pressure through the ordinary tubing was not sufficient to keep them in proper motion, and it became necessary to increase the pressure. The eggs

hatched successfully, the first fry appearing in the jar on May 20, having taken just a week to hatch, with an average temperature of 65°. After holding the fish in pens until the 1st of June they were all released, as the indications were that they were not becoming any riper. Two or three were killed and opened, and the eggs appeared to be caked together and worthless.

On the Lamoille River sturgeon made their first appearance on May 15. Trap and gill nets were used, but the majority were caught by hooking them at a place on the river called "sturgeon hole," where spawning sturgeon apparently collect. The water here is too deep to spear the fish, and nets can not be used; but they are taken by twitching them up with hooks, men watching the hole night and day. Many breeders were obtained in this way, 27 being caught on May 22, when the temperature of the water was 68°. Nearly all of these were ripe males, but on the afternoon of the next day two ripe females were captured. As the fish did not struggle violently at first, the men were able to stop the flow of eggs by stuffing handkerchiefs into the vent. They were then towed across the river, where the males had been secured, and were instantly killed by a blow on the head. In this way 1,300,000 eggs, were taken, but soon after the weather became extremely cold, the temperature of the water dropping several degrees, and as no more sturgeon were captured the work was abandoned and those in confinement were turned loose. Efforts were then made to catch sturgeon on McNall Bay, in Lake Champlain, a short distance south of the mouth of the Lamoille. On the 4th or 5th of June three apparently ripe females were captured, but when opened the eggs were found to be insufficiently advanced for fertilization. A number of others were caught in this bay during the next few days, but no more impregnated eggs were secured, and on June 12 efforts were discontinued. The sturgeon eggs were found, by actual count, to average 850 to the fluid ounce. They are apparently amorphous, and of a dull, dirty color, but this appearance is caused by a cobwebby film which surrounds each egg. By squeezing between the fingers the film can be easily separated from the egg, and the eggs then seem spherical, clear, and crystalline, not very different in size from white-fish eggs, though probably somewhat larger. When ripe the eggs come from the parent fish more easily and are somewhat glutinous, but if taken from a freshly caught fish they are not more glutinous than the pike-perch eggs, and will not give any more trouble if treated similarly.

Of the total number of eggs collected (1,320,000) 20,000 were hatched at Swanton, 380,000 were sent to Cape Vincent, where they were lost, and the balance were lost at the fishing-grounds. In the opinion of the superintendent, the following points with reference to the collection of sturgeon eggs seem to be pretty well established:

Lake sturgeon go up the tributary rivers of Lake Champlain to spawn. They ascend different rivers at different times, the time for each river apparently being determined by the temperature of the

water. The river that the spawning sturgeon of Lake Champlain first ascend is the Missisquoi, in the extreme northwestern corner of Vermont. They ascend this stream very soon after the pike perch have finished spawning in the river, which is usually the latter part of April. The largest number of ripe fish appeared this season about May 13, and were all gone by May 20.

The sturgeon ascend the Lamoille, a Vermont river, which flows into the lake about 30 miles south of the Missisquoi, somewhat later. This year their first appearance at the mouth of this river was about the middle of May, and they collected in the sturgeon hole in the greatest numbers for spawning on May 23. By the end of the month they had all left the river.

The lake sturgeon spawn in the shallow waters of the lake in June. At least, there is a spawning-bed in the shallow water of the bay just south of the mouth of the Lamoille, where the sturgeon come at that time to deposit their eggs. Parent fish collect in this bay to spawn about two weeks later than when they are found in the greatest numbers in the sturgeon hole of the Lamoille. The largest number of ripe ones was observed on June 4, and by June 15 they had all left the spawning-grounds of the bay.

As far as could be observed, lake sturgeon will not spawn until the water reaches a temperature of 60° F. It is concluded, therefore, that they require water at or above 60°, though of course this must be accepted only as an inference.

The lake sturgeon spawn at other places later than they do in the bay just mentioned, as is evidenced by the fact that parent fish were captured in June with eggs that would not have been ripe for a fortnight, and others with eggs that would not have ripened for a month or longer. Sturgeon do not seem to ripen their eggs well in confinement, unless very nearly ripe when captured. If the fish in the pens were confined too long their eggs caked together and were otherwise very poor, and probably would not have been susceptible to impregnation even if they had ripened sufficiently to be extruded from the fish; but this should not be accepted as conclusive, as means will probably be eventually found for keeping sturgeon in captivity without injury to their eggs till ready to spawn.

The spawning season at the various grounds of the lake sturgeon is very short. They are doubtless spawning somewhere all summer, but at any specified ground it is not believed they are in the act of spawning over three or four days. In order to be on the safe side, wide limits have been set to the period during which the spawning sturgeon remain on the spawning-beds, but after a more thorough investigation these limits may be much narrowed.

Unless some device has been adopted for forcibly retaining the eggs in the sturgeon, it seems almost useless to attempt to strip a ripe fish after it has once been lifted from the water alive, as a few seconds of time and a few powerful strokes of the tail hopelessly

scatter all the eggs. It must be ascertained whether the fish is ripe before it is taken from the water, or the instant it is lifted from the water. The vent can then be plugged, the fish put in a strait-jacket, and the eggs taken without difficulty. Various methods of plugging the parent sturgeon were tried, the most effective of which was to stuff a handkerchief instantly into the vent and keep it there, but if the fish is given any time to struggle the eggs will be lost.

Once the eggs of the lake sturgeon are taken it is an easy matter to impregnate them. It nearly always happens when a straggling ripe female is found, or when the females ripen in confinement, that ripe males for fertilizing the eggs can not be obtained, but if ripe females are captured during the three or four days they are on the spawning-beds, ripe males will be found in abundance. When the ripe females in the Lamoille sturgeon hole were caught a quart of milt might have been taken from the males had it been necessary.

The eggs of the lake sturgeon are easily hatched in any jars used in hatching pike perch and white-fish if a stream of water is run through the jars with sufficient pressure to keep the eggs in constant motion. Probably 80 to 90 per cent of lake-sturgeon eggs taken in future will be hatched.

In the latter part of April about 1,400 eggs were secured from the steelhead trout hatched at the station in 1897 from eggs sent from California and kept in tanks in the hatchery. A large percentage of the eggs were impregnated and hatched, producing healthy fry.

Steamer Fish Hawk (James A. Smith in charge).

As soon as practicable after the vessel arrived on the Delaware River on April 30 the hatching apparatus was erected on the main decks and arrangements made for sending spawn-takers to the fishing shores at Howells Cove, Bennett's, and Cramer Hill, and to the gill nets off Billingsport, N. J. No ripe fish were found until May 6, probably because of the extremely cool weather which prevailed. Daily collections of eggs continued from that date to June 13, during which period 115,033,000 were secured and 52,813,000 fry hatched and distributed; 24,706,000 fertilized eggs were transferred to Havre de Grace, Md., 2,051,000 to Central Station, Washington, D. C., 4,235,000 to the Maryland Fish Commission at Druid Hill Park, Baltimore, and 1,419,000 to the Pan-American Exposition, Buffalo, N. Y. Owing to lack of hatching facilities 6,720,000 were deposited on the spawning-grounds. The fry were planted in streams along the coast from the mouth of the Delaware Bay to Massachusetts. Of the total number of eggs taken 76,955,000 were secured from the three seines referred to above, 49,000,000 from the Howell Cove seine, and 38,078,000 from the gill-net fishermen off Billingsport.

Though not quite as many shad were caught by the fishermen as the previous year, the fish-cultural work was the most successful and satisfactory ever done by the *Fish Hawk*, for which credit is due not

only to the officers and men belonging to the vessel, but to the fishermen, who assisted the spawn-takers to the extent of their ability in securing all the eggs possible.

There was a decided increase this season in the capture of Atlantic salmon in the Delaware River near Gloucester. Nine specimens, weighing 8 to 15 pounds each, were taken at Howells Cove; two were captured at Bennett's fishery, weighing 11 and 15 pounds, respectively; and one, weighing 14½ pounds, in a gill net off Camden. The prices received for them varied from 40 to 45 cents per pound.

Battery Station, Maryland (J. N. Wisner, Superintendent).

The work of getting the station ready for shad propagation commenced in March. The machinery was placed in order and a number of minor changes made which tended to increase its efficiency. As for several years the hatching facilities had not been adequate, 280 new jars were purchased and the necessary tables provided, which of course necessitated the extension of the circulating system. The old boat railway, which had been in a dilapidated condition for several years, was torn out and rebuilt, and a scow was constructed for transferring fry from Battery Station to Havre de Grace. A supply of herring roe was also canned and shipped to Wytheville, Va., and Erwin, Tenn., to be used as trout food.

As the egg-taking season approached arrangements were made for attending all the seining-grounds in the vicinity, a number of sailboats being chartered and a force of spawn-takers employed. The large catch of shad reported below the island indicated a successful season, but for inexplicable causes no eggs were obtained until April 26, and even then the collections were small. On May 1st 8,993,000 were secured, and from then until May 8 large numbers came in, but from that date to the close of the season the daily take amounted to only a little over a million, the total collections aggregating only 61,075,000. In addition to these, 24,706,000 were transferred from the *Fish Hawk* on the Delaware River. At first the small collections were attributed to the cold weather and high water prevailing, but this theory was abandoned later when weather conditions became more favorable. The fish apparently abandoned their usual spawning-grounds. In a single night over 5,000 shad were taken by gillers in the vicinity of Port Deposit, and on one day 1,900 were secured at one of the floats where a large seine is fished.

From the eggs collected at the station 38,845,000 fry were hatched and planted, a little over 63 per cent of the number collected. The eggs from the *Fish Hawk* produced 6,548,000, or less than 27 per cent of the number transferred.

The buildings at the station are in good repair, but the condition of the wharves is deplorable. It is urged that an appropriation be secured for the purchase of larger and better launches, as those at the station are very old.

BRYAN POINT STATION, MARYLAND (L. G. HARRON IN CHARGE).

The work of preparing the station for the season's operations was commenced in March, and everything was in readiness by April 13; but as the weather was very cold and unseasonable the force of spawn-takers was not taken on until April 19. The first eggs came in the next day, but the catch of shad was exceedingly small, and at the end of April only 9,795,000 eggs had been secured, whereas the collections at the same time the previous year amounted to over 49,000,000. Unfavorable conditions prevailed throughout the entire season, frequent rains causing freshets and muddy water, which, with the low temperature and the scarcity of shad, proved so detrimental to the work that only 33,321,000 were obtained. Of these, 1,011,000 were shipped to Central Station. The others were hatched at Bryan Point, producing 27,154,000 fry, which were distributed in North Carolina, South Carolina, Georgia, and Florida, and on the natural spawning-grounds in the Potomac River between Broad and Occoquan creeks.

The spawn-takers were dismissed on May 23, and on the 30th the station was closed and placed in charge of a watchman. The temporary force during the season consisted of 44 spawn-takers, 5 firemen, 3 assistants in hatchery, 1 coxswain and engineer, and 2 cooks.

The following shows the daily collection of eggs and the mean temperature of air and water:

Date.	Received.	Mean temperature.		Date.	Received.	Mean temperature.	
		Air.	Water.			Air.	Water.
		° F.	° F.			° F.	° F.
April 20	136,000	56	50	May 9	836,000	68	64
April 21	279,000	57	51	May 10	1,110,000	64	64
April 22	84,000	54	49	May 11	555,000	69	65
April 23	419,000	54	49	May 12	965,000	70	65
April 24	520,000	51	48	May 13	1,300,000	65	64
April 25	207,000	54	49	May 14	662,000	66	63
April 26	451,000	61	51	May 15	835,000	69	64
April 27	883,000	57	52	May 16	586,000	71	65
April 28	1,886,000	58	53	May 17	184,000	72	66
April 29	2,474,000	64	54	May 18	224,000	71	66
April 30	2,456,000	72	55	May 19	135,000	63	65
May 1	2,062,000	66	59	May 20	527,000	63	65
May 2	3,187,000	71	61	May 21	828,000	67	65
May 3	1,082,000	68	66	May 22	379,000		
May 4	1,632,000	65	63	May 23	751,000	73	67
May 5	1,020,000	69	64	May 24	985,000	76	66
May 6	1,239,000	66	64	May 27		61	63
May 7	1,485,000	64	64	May 28		66	64
May 8	957,000	67	63	May 30		68	65

A number of improvements were made during the year, the most important being the construction of a wharf 70 feet long by 12 feet wide, running out from the front of the hatchery. This has proved a great convenience, and will materially reduce the expense of operating the station, as vessels plying up and down the river now land at the station daily, thus obviating the necessity for an extra launch, which has heretofore been employed mainly for running between the station and Alexandria for the purpose of carrying down provisions and bringing up eggs and fry.

FISH LAKES, WASHINGTON, D. C. (C. K. GREEN, SUPERINTENDENT).

Dr. Rudolph Hessel, who had been in charge of this station since its establishment in 1877, died suddenly on August 19, 1900, and Mr. Z. H. Goldsmith directed operations until November 12, when he was relieved by Mr. J. N. Wisner, field superintendent. Mr. Wisner was relieved on March 1, upon the appointment of C. K. Green.

Work was conducted along the same general lines followed in past years; the ponds were drawn from time to time during the fall and the young fish were assorted and transferred to the breeding-ponds. The season's operations proved very satisfactory, 64,605 yearling and 50 adult large-mouthed black bass, besides 1,531 crappie, being furnished for distribution in the fall.

In November the shad which had been placed in the west pond during the month of May of the previous year were liberated in the Potomac River. It is impossible to give the exact number liberated, but it is believed that there were at least 2,000,000. In May, 1901, 2,000,000 were again placed in the west pond, and at the close of the year large numbers of apparently healthy and vigorous shad could be seen along the partition in deep water.

One of the most important improvements has been the construction of a new outlet for the north pond, which was done under direction of Mr. H. von Bayer, the architect and engineer of the Commission.

Early in April the breeding fish of all kinds were transferred from the retaining ponds to the ponds and partitions previously prepared for breeding purposes. The large-mouthed bass commenced spawning in the north and south ponds on April 28, and it was observed that they spawned not only on the gravel beds which had been placed in the ponds, but also on the weeds close to the water's edge. The first brood of fry appeared on May 6. The last nests were seen on June 10, and at the close of the year there were large numbers of young fish in the ponds.

The adult crappie, numbering 73, were transferred from the retaining ponds to the Seventeenth street ponds in April, and commenced to spawn on May 1, continuing until about the 20th. A number of nests were seen and some fry have been noticed in the pond near the edges.

The crappie in the canal pond spawned on the 29th of April, but as this pond was used for black bass, the fry, estimated at about 8,000, were transferred to the Seventeenth street pond as soon as they raised from the beds. A recent examination shows that they have made excellent growth, being from 1 to 1½ inches in length at the close of the year.

Although the distribution of ornamental fishes has been discontinued, some golden ide, tench, and gold-fish are raised annually for the aquarium at Central Station and for exhibition purposes. Large numbers of young carp are also hatched as food for bass.

Central Station, Washington, D. C. (J. E. Brown in charge).

Work at this station has been conducted on the same lines as heretofore, it being used as a distributing depot for the fish reared at the fish ponds in Washington, and also for hatching the various species of *Salmonidæ* during the winter, for illustrating the fish-cultural work of the Commission. The following table shows the number of eggs received and the fish hatched and planted:

Species.	Received.	Hatched.
Shad	4,571,000	3,640,000
Pike perch	2,000,000	1,750,000
Rainbow trout	9,769	9,030
Brook trout	500	477
Lake trout	14,888	14,319
Loch Leven trout	9,987	9,684
Atlantic salmon	4,993	4,832
Landlocked salmon	4,990	4,832
Scotch sea trout	1,971	1,544
White-fish	317,000	314,000
Total	6,935,098	5,748,718

The superintendent is charged with receiving and shipping freights and express matter passing through the central office. During the past year this involved the handling of 783 shipments and 1,004 receipts. The general distribution apparatus is also stored at this station under his direction. After the distribution season is ended the cars are laid up at Central Station for the winter, during which time their machinery is thoroughly overhauled by the station machinists, thereby saving the Commission thousands of dollars annually.

Central Station Aquarium (L. G. Harron in charge).

From July 1 to September 15 the grotto was closed, it being impracticable, on account of the high temperature of the water, to maintain an exhibit of salt-water specimens.

The salt-water circulating plant was improved by the introduction of a new heater and the installation of an engine for use in operating the salt-water pumps whenever the water pressure might be too low to run the motor.

A supply of salt water was obtained from the Chesapeake Bay early in September, and arrangements were made for restocking the aquarium with marine fishes and other animals collected from points on the Chesapeake and Buzzards Bay. About 1,000 specimens, representing 54 species, were secured from these two sources, and these, with supplies of sea-anemone and star-fish from Gloucester, Mass., stocked the salt-water aquaria to their full capacity. This exhibit remained exceptionally good until about February, when a disease appeared and caused the loss of a great many of the specimens. It attacked their fins and gillrakers, and seemed to eat the flesh from the spines and rays, causing the fish to refuse all of the food. Various remedies, including strong salt baths, were tried, but without effect,

and the ravages continued until April, when most of those surviving succumbed to the rising temperature.

The exhibit of fresh-water fishes indigenous to this region was good throughout the summer, and in October, when the water temperature fell to 60°, consignments of rainbow trout, brook trout, Scotch sea trout, Atlantic salmon, and landlocked salmon were sent from Wytheville, Va., and East Orland, Me.; all of these were about nine months old when received. They continued to thrive until early in May, when a rise in temperature necessitated their removal, and in order to avoid losing them they were planted in suitable waters in Pennsylvania. Attention is again called to the large lot of large-mouthed black bass, which have been carried since July, 1896, in a tank 6 feet long by 4 feet wide, on the main floor of Central Station. During this time they have suffered no losses.

Following is a list of salt-water and fresh-water species exhibited during the year:

Salt-water species.—Sheepshead, tautog, spot or goody, croaker, sea trout, pompano, bur-fish, toad-fish, sea bass, gray snapper, black drum, sea robin, jumping mullet, swell-fish, spade-fish, sea-horse, yellow-tail, blenny, striped bass, hog-choker, pig-fish, mummichog, king-fish, moon-fish, star-gazer, pin-fish, flounder, tongue sole, remora, stickleback, pipe-fish, file-fish, chætodon, cunner, scup, sea raven, sculpin, tomcod, lobster, spider crab, hermit crab, blue crab, star-fish, shrimp, sea-urchin, sea-anemone.

Fresh-water species.—Rainbow trout, brook trout, steelhead trout, Scotch sea trout, Atlantic salmon, landlocked salmon, large-mouthed black bass, small-mouthed black bass, rock bass, crappie, yellow perch, white perch, common tench, golden tench, golden ide, gold-fish, paradise-fish, common sun-fish, banded sun-fish, common sucker, chub sucker, channel cat-fish, yellow cat-fish, mill roach, German carp, pickerel, gar pike, sturgeon, common eel, lamprey eel, top minnow, alligator, terrapin, snapping turtle.

The following shows the maximum and minimum temperatures of salt and fresh water in the tanks during the year:

Month.	Fresh water.		Month.	Salt water.	
	Max.	Min.		Max.	Min.
	°F.	°F.		°F.	°F.
July	84	77	September	74	62
August	84	78	October	74	56
September	83	70	November	64	52
October	72	60	December	58	52
November	63	47	January	59	54
December	47	36	February	58	53
January	38	33	March	62	49
February	35	33	April	68	52
March	48	34	May	72	61
April	55	45	June	78	60
May	65	56			
June	76	62			

WYTHEVILLE STATION, VIRGINIA (GEORGE A. SEAGLE, SUPERINTENDENT).

Immediately after the 1st of July, when the special appropriation of $2,500 for the construction of additional ponds became available, the material for this work was assembled and operations commenced. It was decided to construct the pond on that part of the station property lying west of the road leading to the railroad. It is irregularly

shaped, covers about 2 acres of land, and is from 3 to 8 feet deep. The embankment on the north and west sides is 600 feet long, from 20 to 30 feet wide at its base, and from 8 to 12 feet high. In order to protect it from high water, a piling wall 7 feet high was built along Tates Run and along the west end of the pond. On the east end the old road bed was raised from 4 to 6 feet and widened, so that it now serves not only as a wagon road but as a strong embankment for the pond as well. The water supply was obtained from Tates Run, 1,100 feet above the pond, a 12-inch terra-cotta pipe laid in cement being run alongside the old pipe, through land belonging to R. G. Corvin. Between the two main pipe lines a 5-inch tile pipe was laid to carry off leakage and surface drainage, thus preventing injury to the lands for agricultural purposes.

In addition to the usual cribs, screens, etc., for the outlet of water, which are situated in the northeast corner of the pond, a tight crib-like arrangement was constructed about midway on the east end of the pond, at the foot of the road embankment. Connected with this crib is an offshoot from the supply pipe for the old series of ponds, through which the main line is flushed. This is accomplished by withdrawing a plug from the end of the pipe by means of a lever. The water in flushing passes through the crib and enters a 12-inch pipe line connected at the other end, and is then conveyed to Tates Run. After flushing, the pipe is closed by reversing the lever. The overflow from the large pond passes into the series of ponds below, thereby increasing the water supply.

After the completion of this pond, in October, a carpenter shop 15 by 28 feet, 1⅔ stories high, was built 50 feet west of the hatchery. The upper floor is used for the storage of cans, tools, and other material, and the lower one as a carpenter shop, meat room, etc. A number of other improvements were also made, such as the building of a porch 6 by 30 feet on the south side of the hatchery, grading and sodding embankments, filling in old blind ditches, regrading and seeding to grass the small bottom east of the spring, building fences, painting buildings, etc.

The fish-cultural operations for the year consisted in the propagation and distribution of rainbow trout, brook trout, black bass, and rock bass. The distribution of fish hatched in the previous year commenced October 6 and continued to December 23, during which period 165,480 rainbow trout, 8,192 brook trout, 8,730 rock bass, and 1,812 black bass were distributed; also 15,816 black bass and 800 crappie were transferred from other points.

The food used during the summer for the young and adult fish consisted of beef liver and mush, mixed in varying proportions, according to the size of the fish.

In September a loss of 156 large breeding trout from suffocation occurred in one of the ponds. The water at the time was very low,

barely sufficient in the ponds north of the hatchery to sustain life, consequently this loss was unavoidable.

The breeding stock of rainbow trout on hand at the beginning of the year numbered about 4,000, their age ranging from one to ten years. Of these, about 2,500 were classed as spawners. The season extended from November 4 to February 10, and resulted in the collection of 1,255,800 eggs from 1,224 fish, an average of 1,025. The size of the eggs was more uniform than last season, the variation being from 355 to 438 to the ounce, though the majority ran about 381. About 25 per cent of the eggs collected were unfertilized or lost during incubation, 417,000 were shipped to other stations and foreign applicants, and 524,000 were hatched.

The loss of brood-fish was more than double that of any previous season, amounting to nearly 700, or about 33 per cent of the fish handled. This was unquestionably due to the inexperience of the spawn-takers, the foreman and fish-culturist both being absent during the spawning period. Most of the fish lost were the larger females.

In January two consignments of brook-trout eggs were purchased from New England dealers, and reached the station in apparently good condition, though there was a subsequent loss of several thousand.

For the first three weeks after hatching the rainbow and brook-trout fry were fed six times a day on canned herring roe. From that time they were fed four times a day until they were ten weeks old, when the roe was gradually discontinued and liver substituted. At the age of three months the usual mixture of liver and mush was given to them.

The water was unusually muddy during the summer months, which was of course very injurious to the young fish of all kinds and especially to brook trout. The death rate increased from 40 to 50 per day to several hundred, and on two or three occasions, when the water was very muddy, over a thousand were lost.

The rainbow trout were not so seriously affected from this cause, but late in June they were attacked by parasites in large numbers. This parasite (*Gyrodactylus elegans*) is described by Livingston Stone in his book on the Domesticated Trout, also by J. J. Armistead, in Angler's Paradise. After trying a number of remedies it was finally destroyed by the use of common apple vinegar. The vinegar was diluted with water to a 25 per cent solution, and in this the fish were dipped, a net full at a time, and allowed to remain from 2 to 4 seconds, according to the size and age. This treatment does not injure the fish and is an absolute remedy for the parasite. Care should be taken, however, not to have the solution too strong nor allow the fish to remain in it too long.

Early in April the brood rock bass were placed in suitable ponds and a number of gravel nests provided for them. On April 19, just as

the fish had commenced to nest, the ponds were overflowed and the nests washed away, many of them being buried in mud and drift. The ponds were at once repaired and the remaining fish were distributed in them again. They soon resumed their nesting, and a good many young have been seen, though the number hatched could not be determined at the end of the year.

On April 26 the breeding-ponds of the black bass were stocked, and on May 7, when one of the ponds was partially drawn for the purpose of repairing a leak, numbers of fry were noticed. Owing to the muddy condition of the water it has been impossible to make any estimate of the number on hand.

Following is a list of the stock on hand at the close of the year:

Species.	Calendar year in which fishes were hatched.				
	1901.	1900.	1899.	1898.	1897 or before.
Rainbow trout	318,000	5,080	598	339	1,872
Brook trout	19,400				
Large mouth black bass			36		57
Small mouth black bass					6
Rock bass			39	80	180
Carp					20
Gold-fish					15

EDENTON STATION, N. C., (S. G. WORTH, SUPERINTENDENT).

Early in March arrangements were made for collecting shad eggs from the seines and the trap and gill nets fished in the Chowan River, Roanoke River, and Albemarle Sound, an additional steamer being chartered and a large force of spawn-takers and assistants employed. The results were far in excess of any previous work on the Albemarle Sound, 75,400,000 eggs being collected and transferred to the station from March 29 to May 15. The run of shad was large and the herring catch under the average, thereby rendering conditions most favorable. The temperature throughout the spring was also below normal, another favorable circumstance.

Arrangements were made with Dr. Capehart for securing eggs from the seine fished at Avoca, and from this source 61,195,000 were derived, as measured at the station. From the trap nets, gill nets, and other seines 14,205,000 were collected, nearly 4,000,000 more than the previous season. At Skinner Point there was a decided falling off as compared with the past year, owing probably to adverse winds. The trap nets on the Chowan River afforded but few eggs, but under different conditions it is believed that the yield at this point may be materially increased. Conditions on the Roanoke were unusually favorable, only one freshet occurring during the season; this lasted ten days. The Willow Branch seine, on the Chowan, from which large numbers were collected the year before, was not fished this season, but the gillers on the Roanoke furnished twice the number they

did the previous year, and this field will doubtless prove even more productive in future.

On April 24 the superintendent was relieved from duty, and Mr. J. B. Rogers, fish-culturist, was placed in charge until the close of the season. The egg productions by areas were as follows: From the Chowan River, 1,905,000; Roanoke River, 10,872,000; Albemarle Sound, 62,623,000, a total of 75,400,000. By apparatus the production may be recapitulated as follows: Trap nets, 2,783,000; gill nets, 3,766,000; seines, 68,851,000.

The number of fry produced was 51,280,000, or 68 per cent of the number of eggs received. A study of completed tables of production shows an abnormal loss on 13 lots of eggs between April 8 and May 1. Two of these lots suffered from an electric storm, namely, those on April 30 and May 1. The other 11 lots referred to were selected from the records as representing the largest individual shrinkage, and are as follows:

Date.	Eggs received.	Fry produced.	Per cent of loss.
Apr. 8	2,666,000	1,085,000	52
Apr. 9	380,000	204,000	47
Apr. 10	1,862,000	702,000	63
Apr. 12	3,701,000	1,457,000	61
Apr. 13	1,393,000	579,000	59
Apr. 15	928,000	434,000	54
Apr. 16	1,257,000	526,000	58
Apr. 17	3,458,000	1,762,000	49
Apr. 18	3,465,000	1,265,000	64
Apr. 19	3,360,000	1,107,000	77
Apr. 22	3,405,000	1,400,000	59
Total	25,875,000	10,521,000	

While on the 8,285,000 eggs of April 30 and May 1, killed by an electrical storm, there was a loss of 50 per cent, on the above 11 lots there was a loss of 60 per cent. On all other eggs of the season there was a loss of only 11 per cent, as shown below:

Designation.	Eggs received.	Fry produced.	Egg loss.	Per cent of loss.
Two lots of April 30 and May 1	8,285,000	4,160,000	4,125,000	50
Eleven lots, April 8 to 22	25,875,000	10,521,000	15,354,000	60
All other lots	41,240,000	36,599,000	4,641,000	11
Total	75,400,000	51,280,000	24,120,000	32

Of the eggs collected in 1900, 63 per cent were hatched.

Air bubbles again formed in the water supply to the hatchery on sudden rises of temperature, due probably to rapid expansion of air in the water-pipes between the suction well and hatching-jars; this suggests the desirability of covering the exposed parts of the pipe system with asbestus or some other nonconductor.

The fry were distributed by messengers in North Carolina waters, principally in Albemarle Sound and its tributaries.

The following table shows the daily collection of eggs received and fry hatched and planted at Edenton during the season:

Date.	Eggs received.	Fry hatched and planted.	Date.	Eggs received.	Fry hatched and planted.
Mar. 29	165,000	65,000	Apr. 23	1,771,000	1,310,000
Mar. 30	93,000	80,000	Apr. 24	1,375,000	1,090,000
Apr. 1	824,000	558,000	Apr. 25	2,060,000	1,575,000
Apr. 2	827,000	582,000	Apr. 26	2,410,000	1,690,000
Apr. 4	184,000	135,000	Apr. 27	3,725,000	2,755,000
Apr. 5	288,000	190,000	Apr. 29	1,990,000	1,450,000
Apr. 6	1,364,000	983,000	Apr. 30	3,915,000	1,225,000
Apr. 8	2,266,000	1,208,000	May 1	4,370,000	2,900,000
Apr. 9	1,165,000	835,000	May 2	5,140,000	4,190,000
Apr. 10	380,000	176,000	May 3	4,675,000	3,645,000
Apr. 11	1,862,000	1,160,000	May 4	2,835,000	2,360,000
Apr. 12	3,701,000	2,244,000	May 6	2,240,000	2,030,000
Apr. 13	1,393,000	814,000	May 7	2,395,000	2,175,000
Apr. 15	928,000	300,000	May 8	1,040,000	910,000
Apr. 16	1,257,000	700,000	May 9	905,000	825,000
Apr. 17	3,458,000	1,686,000	May 10	190,000	175,000
Apr. 18	3,465,000	2,200,000	May 11	350,000	335,000
Apr. 19	3,360,000	2,253,000	May 15	99,000	79,000
Apr. 20	3,530,000	2,387,000			
Apr. 22	3,405,000	2,005,000	Total	75,400,000	51,280,000

ERWIN STATION, TENNESSEE (ALEX. JONES, SUPERINTENDENT).

The fingerlings on hand at the beginning of the year (130,560 rainbow trout and 2,500 black bass) were carried until fall and fed as usual on a mush made of shorts, corn meal, and beef liver. They were distributed between October and December, the output being 1,258 black bass and 89,125 rainbow trout, not including 5,000 trout held for brood stock.

For the purpose of testing the merits of a manufactured preparation called animal meal, two 1,000 lots of rainbow trout were counted and weighed on October 22 and placed in ponds 9 and 10, where they remained until December 11, when they were again counted and weighed. The food given the fish in pond 9 consisted of a mush composed of 6 parts corn meal, 14 parts shorts, 3 parts animal meal, and 1 of salt. During the period mentioned the fish in pond 9 consumed 96 pounds of this material, the cost of same being $1.31, and on December 11 they were found to have made a gain of 3 pounds, their weight on October 22 being 6¾ pounds. Each pound of fish gained therefore cost 43.6 cents. The fish in pond 10 weighed 7 pounds at the commencement of the experiment, and when taken out on December 11 showed a gain of 8½ pounds. In this pond 96 pounds of food were used, costing $1.58, making the cost of each pound of fish gained 19 cents. The preparation given this lot consisted of 3 parts shorts and corn meal to 2 parts of liver.

Similar tests were made later in the same ponds with two 500 lots, the fish being held until May 20. Those fed on the preparation containing the animal meal were found to have gained 37 pounds, at a cost of 15 cents per pound, and the other lot had gained 77 pounds, at a cost of 8½ cents per pound. As the food used in these experiments was carefully weighed and the conditions were identical, it seems apparent that liver and mush are preferable.

The spawning season of the rainbow trout extended from November 25 to January 13, the collection of eggs amounting to 262,600. Of these, 146,900 were eyed, producing 135,800 fry; 100,000 eggs were also transferred from Wytheville and yielded 84,300 fry, giving a total of 220,000 young trout, 130,000 of which were distributed during the spring. At the close of the year there were 141,233 on hand.

The eggs were of much better quality than those of the previous year, which was attributed to the fact that the adult fish had been kept in a pond provided with a raceway, thus obviating the necessity for seining them, as had been customary in previous years. The fry were fed in the usual way, first on herring roe, then on beef liver, and on liver and mush as they increased in size. They were transferred from troughs to the rearing-ponds as soon as they commenced taking food, as experience shows that they are more liable to diseases of various kinds when retained in troughs. The loss was heavy in June, though lighter than in previous years.

During the winter 100,000 eyed brook-trout eggs were purchased from dealers in Massachusetts, and 92,295 strong, vigorous fry were hatched from them. These did well until they commenced to feed, when heavy losses were experienced. In May 10,000 of the fry were planted in local waters and the remainder, 25,000, were retained for the fall distribution.

The stock of black bass was increased during the fall by the receipt of 54 adults, giving a total of 60 brood fish. These nested in the new ponds, and while it is impossible to correctly estimate the number of fry resulting, it is believed there were over 5,000 on June 30. Large numbers of predatory birds, animals, and reptiles were killed on the grounds during the year.

In addition to the land already owned by the Government, a tract of 40 acres was acquired during the year, and a half acre was leased for a period of fifty years for the purpose of controlling the water supply from its source to the end of the system. A great deal of work was done during the summer with the appropriation of $5,000 made by Congress for the construction of bass ponds and other improvements. The new tract was inclosed by means of a wire fence 5 feet high. The posts to which the wire was fastened were of oak, set 2½ feet in the ground and tarred, the exposed part being painted with oxide of iron and capped with blocks an inch thick, making them as nearly waterproof as practicable. On this tract seven ponds of different dimensions and depths were constructed (Nos. 33 to 39). A watchman's tower was also erected on the ground between ponds 35 and 36, to be used for storing equipment and for the shelter of the watchman during inclement weather. An office was erected for the superintendent between the hatchery and residence, 14 by 22 feet, the hatchery was ceiled and varnished, a number of changes were made in the method of supplying water to the various ponds, and a large number of maple trees were set out on the reservation.

COLD SPRINGS STATION, GEORGIA (J. J. STRANAHAN, SUPERINTENDENT).

Very little fish-cultural work was accomplished during the year, owing to the incomplete condition of the station. The fingerlings on hand in July were distributed during the fall as follows: 275 black bass, 306 warmouth bass, 3,367 bream, and 258 sun-fish.

Efforts were made during the winter to increase the stock of brood fish, and in January the superintendent, assisted by the fish-culturist, made a number of trips to Dead Lake, Florida, and succeeded in transferring 137 black bass and 28 strawberry bass, though fully half of them died from the effects of fungus within a few days after reaching the station. Those that survived spawned freely, but all of their eggs were lost, turning white on the nest within a few hours. Brood fish were secured from streams near the station, among them 34 speckled cat-fish, 24 of which died within three months from fungus.

About 50,000 roaches and pond chubs were obtained from a pond near Greenville, about 14 miles distant from the station, and the fry from these were utilized as food for the young bass.

The adult bass, bream, and cat-fish were placed in the various breeding-ponds, and although it is impossible to estimate accurately the number of fry on hand at the close of the year, it is thought there were at least 10,000 bream and a fair supply of cat-fish. Over 4,000 young black bass had also been counted, assorted, and transferred to the rearing-ponds.

The bottoms of all the ponds at the station have been enriched and planted with suitable vegetation, in order to furnish a certain amount of natural food and also to protect the young fish from the sun and from birds of prey.

After removing the young fish from the breeding to the rearing ponds they were fed about six times a day on finely chopped fish. They were also given as much minute animal life as practicable and a certain amount of live minnows. The loss from cannibalism was not large, as the fish were assorted according to size at regular intervals, but a certain percentage died from starvation, notwithstanding the care exercised in feeding them. For handling the young fish a seine of bobbinet is used.

After removing the fry from the ponds the water was drawn down and the inclosures thoroughly washed with a saturated solution of salt.

Following is a list of brood stock on hand at the close of the year:

Species.	Adults.	Yearlings.
Black bass	108	280
Bream	114	96
Strawberry bass	9	.....
Warmouth bass	20	.....
Speckled cat-fish	44	.....
Carp	16	860
Total	311	1,236

PUT-IN BAY STATION, OHIO (S. W. DOWNING, SUPERINTENDENT).

The capacity of the hatchery has been materially increased by the construction of an extension 24 feet by 28 feet. This was equipped with three single batteries capable of holding 180 jars each, giving the station a capacity of 1,500 jars. The new jars, which were of the type designed by Mr. Stranahan, and to which reference has been made in previous reports, were found to do fully as good work as the McDonald jar, and are much more convenient to operate, as they are of the open-top pattern. A sleeping room was fitted up in the space over the fry tanks for the use of the fireman, the building was painted, and a number of other minor improvements made.

Early in the fall arrangements were made for the collection of white-fish eggs at various points on Lake Erie, and for penning the fish at Monroe Piers, Michigan, and Put-in Bay, Ohio. Although the spawning season was later than ever before, commencing November 17, indications at first pointed to a very large take. A series of heavy storms occurred shortly after, however, driving the white-fish from the spawning-grounds to deep water, and damaging the nets so badly that the fishermen were compelled to remove many of them for repair, and as the season was far advanced by this time, they were not reset.

Taken as a whole, the season will probably be recorded as the poorest ever known on Lake Erie, so far as fishing operations are concerned. The greatest damage done to nets was in the vicinity of Kelley Island, Put-in Bay, Port Clinton, and Toledo. The Monroe fields, being on the north shore, were protected. The first fish were penned at this point on November 10 and the last on December 3. At Put-in Bay penning commenced on November 8th and lasted until December 5th, 14,739 being penned at the two points, 5,388 of which were females. These yielded 148,334,000 eggs, an average of about 25,000 per fish. The spawning of the fish held in pens continued from November 20 to December 31.

In addition to the eggs derived from the fish referred to above, spawn-takers stationed at Port Clinton, Kelley Island, North Bass, Monroe, and Put-in Bay collected 45,900,000 eggs, bringing the total to 194,234,000. The average cost of these per million was $13.95, the cost at different points varying from 40 cents to $1.99 per quart.

The experience of the past two years clearly demonstrates that it is much cheaper to collect eggs from fish that have been penned than to rely upon collections made by men in the open field, and that the outcome is more certain.

During the fall 21,592,000 white-fish eggs were transferred to the Cape Vincent Station, and 6,000,000 were sent to the State Fish Commission at Erie, Pa. The others were hatched at the station, yielding 125,100,000 fry, which were planted at suitable points in Lake Erie. They were all hatched within a period of 21 days, the first coming out on April 7 and the last on April 27.

In view of the deep interest manifested in the lake-herring work by the fishermen on Lake Erie, preparations were made to operate on an extended scale, but owing to the severity of the season, the prospects seemed very poor. It was learned in December, however, that spawning herring were being taken in large numbers at Vermilion, Ohio, and the spawn-takers, sent immediately to that point, secured 61,760,000 eggs from December 3 to 11. At this time the weather became so cold that the fishermen were obliged to use hot water on their nets to keep them from freezing while being taken on board, and as the hot water spoiled all the eggs with which it came in contact the work was discontinued. Of the eggs collected, 30,820,000 were shipped to the Pennsylvania Fish Commission at Erie, Pa., and the remaining 30,940,000 were hatched at Put-in Bay. The first fry came out on April 6 and the last on April 15, the total number hatched being 20,200,000. These were liberated between April 7 and 17 at points in the vicinity of Put-in Bay.

Early in April spawn-takers were stationed at different points on Lake Erie for the purpose of collecting pike-perch eggs. The season opened propitiously on the 10th of April, fish being taken in large numbers and in good condition; but a storm of four days' duration commenced on April 19, which not only wrecked nearly all the nets, but roiled the water to such an extent that the fish left the grounds and it was feared that the season was ended. They came back in considerable numbers, however, and the collection of eggs continued to April 30, the season being the longest ever recorded at this station. It was also one of the most successful, as it resulted in the collection of 341,025,000 eggs; 219,525,000 were received from Toledo, 75,300,000 from Monroe, and 46,200,000 from Port Clinton. The cost of these varied from $3.70 to $8.50 per million, Toledo proving the cheapest field of operations and Port Clinton the most expensive. Shipments of pike-perch eggs were made as follows: 10,000,000 to the Missouri Fish Commission at St. Joseph, Mo.; 32,000,000 to the Michigan Commission at Detroit, Mich.; 6,000,000 to the Pan-American Exposition, Buffalo, N. Y., and 2,000,000 to Central Station, Washington, D. C. The balance were hatched at the station, producing 160,087,000 fry, 46,000,000 of which were utilized in stocking inland waters. The remainder were planted in Lake Erie. The hatching period extended from May 6 to May 17, the earliest eggs being in incubation 26 days and the latest 17 days.

Exhaustive experiments, which were again conducted for the purpose of determining the value of starch and swamp muck for preventing adhesion of the eggs, seemed to demonstrate that no special advantage is to be derived from the use of either of these materials, except that it reduces the work of the spawn-taker somewhat, as it prevents the eggs from sticking together, and he does not have to separate them after fertilization has taken place. In conducting these experiments each lot of eggs was kept separate and the conditions carefully noted. It was observed that the same variation in the

quality of the eggs taken by the same person, but on different days, occurred in the use of both muck and starch, some days the quality seeming to favor the use of starch, and others the muck, but on the whole the eggs treated with starch were of superior quality.

The old method of continuously stirring the eggs during the process of fertilization was abandoned, and the following instructions were issued to the spawn-takers:

Take the eggs from one fish (if large), use plenty of milt, do not stir but add a little water, let stand about half a minute and then lower and empty carefully into the keg, which should contain about 2 inches of water. This process should be continued until the keg contains as many eggs as can be carried in it. After the eggs have all been taken, add a little water to each keg, pouring a little on and a little off constantly until the eggs are washed clean of milt and hardened thoroughly, after which the water should be changed as often as once an hour. In adding water it must never be poured directly on the eggs, but against the side of the keg, and care must be exercised not to empty off enough of the water to expose the eggs to the air, as during the entire time they should be covered to a depth of 2 inches. No stirring of the eggs is to be done during the entire process, as this has been found to cause the rupture of large numbers.

Northville Station and Substations in Michigan (Frank N. Clark in charge).

The work for the first three months of the fiscal year consisted chiefly in caring for the fish at Northville, maintenance of buildings and ponds at the various stations in Michigan, the construction of additional transportation apparatus, and repairs to the hatching equipment. The lake-trout fingerlings that had been carried through the spring were liberated in July.

In August the superintendent visited Mackinaw, Sault Ste. Marie, Petoskey, Charlevoix, and other points on Lakes Superior and Michigan to arrange for lake-trout collections during the coming season. Spawn-takers were sent to the northern shore of Lake Superior in September to collect eggs, but the work there was discontinued on October 24, as only 704,000 had been obtained. At Marquette 2,375,000 eggs were secured, and at Mackinaw City 200,000, all taken in October, during the open season.

It having been decided, after conference with the State fish and game warden, not to attempt fishing during the closed season at any point except Beaver Island, Mr. H. H. Mancha was sent to that point on October 28, with instructions to collect under the same conditions as heretofore. Arrangements were made with two of the commercial fishermen to fish at such points and such times as might be found advisable, and as a result 10,500,000 eggs were obtained between November 12 and 28, on which date operations ceased. The height of the spawning season extended from November 18 to November 26,

514 quarts being obtained on the latter day from the two tugs. All the eggs, except 1,500,000 delivered to the Michigan Fish Commission from the field, were forwarded to Northville.

During operations at this point the two tugs captured 9,297 lake trout, weighing 69,271 pounds, and by field measurements 1,659.5 quarts of eggs were obtained from them. The trout caught by McCann's tug averaged 8 pounds in weight and those by Martin's a little less than 7, making the average for the whole about 7.5 pounds.

The fishing was under the supervision of the State fish and game warden and his deputies, who threatened to arrest the agents of the Commission, although operations were conducted in accordance with the laws of the State and with an agreement made with the State fish and game warden the previous year. Through the courtesy of the Attorney-General arrangements were made to have the United States district attorney for Michigan defend any employees that might be interfered with by the State authorities.

Of the 13,779,000 lake-trout eggs collected, 7,267,000 were shipped to other points, 5,766,000 of them being eyed before shipment, and 1,501,000 sent out in the green stage. The balance were hatched at Northville, producing 3,910,000 fry, which were distributed in suitable waters during the early spring and summer. The majority were planted just before the absorption of the sac, but 125,000 were held until June, measuring about 2 inches in length when distributed. The total cost of collecting these eggs was $1,200, or about 9 cents per thousand delivered at the hatchery.

The 9,600 brook-trout fry on hand at the beginning of the fiscal year were transferred from the hatchery to the ponds early in July, and when counted again on October 12 they numbered 7,569, showing a loss of 21 per cent. They did well through the winter, but in April they were apparently attacked in the same way as the brook trout of previous years, and the mortality increased to such an extent that the experiment of thinning them by transferring to other ponds was tried; but this seemed to increase rather than diminish the mortality, and Mr. Marsh was sent to the station to make a thorough investigation of the matter. It is believed that the disease is caused by bacteria, and water-tight ponds of stone will probably be constructed for experimental purposes.

As there were no brood fish on hand in the fall, 1,000,000 brook-trout eggs were purchased from dealers in New England and 32,000 were received from Kalamazoo, Mich., in exchange for eggs of the rainbow trout. The eggs developed well, the hatching being done in spring water. The fry began coming out in February and were ready for distribution by the middle of March, at which time 991,250 were planted in the waters of Michigan, Indiana, and Ohio; 10,000 were retained for rearing at the station.

During January and March three consignments of rainbow-trout

eggs, aggregating 88,074, arrived from Neosho and Manchester in good condition and produced 69,000 fry, of which 61,000 were planted as fry early in the spring and 8,000 as fingerlings in June.

There were on hand at the beginning of the year 8,000 yearling Loch Leven trout—500 of the hatch of 1897–98 and about 50 ranging from 6 to 10 years in age. The old fish were not used, as it was found that their eggs were worthless, but 103,800 eggs were obtained from the younger fish between November 1 and December 27. These were handled in the Clark box, spring water being used for the first month, when creek water was substituted. This being much colder than the spring water, retarded the hatching so that they did not commence to come out until about the middle of February. In distributing the eggs, 1,000 were shipped in the green state and 20,000 after the eye-spots appeared; from the remainder, 50,000 fry were hatched and planted in Michigan waters during the spring.

An unsuccessful attempt was made to collect sturgeon eggs on the Grand, Muskegon, and Kalamazoo rivers in western Michigan, and also on the Detroit River near Wyandotte. Mr. Thayer, who had been detailed for this work, conducted fishing operations persistently for several weeks, but succeeded in capturing only three sturgeon.

The following table shows the number of fish on hand at Northville at the close of the fiscal year:

Species.	Calendar year in which fish were hatched.					
	1901.	1900.	1899.	1898.	1897.	1894 or earlier.
Steelheads				1,243	169	
Loch Leven trout		5,583		110	231	15
Grayling			51			
Brook trout	9,500	1,532				
Total	9,500	7,115	51	1,353	400	15

The Detroit hatchery, under the immediate charge of Mr. Thayer, was prepared for white-fish work early in the fall, and on November 17 the first eggs were received from the three fisheries on the Detroit River. These were operated in connection with the Wolverine Fish Company of Detroit, on the same conditions as in the previous year.

At Belle Isle fishing operations extending from November 5 to December 9 secured 6,308 male and 5,865 female white-fish, besides 574 undersized ones, which were returned to the river. Those captured at the upper seine were transferred to the lower grounds, where they were held in pens and crates. At Grassy Island 7,254 mature fish were taken, 4,272 males and 2,982 females, 2,609 of which yielded eggs.

From the Belle Isle fish 139,280,000 eggs were obtained, and from those at Grassy Island 64,280,000, giving a total of 203,560,000. The average yield of eggs per female was 25,679. Two shipments, aggregating 31,000,000, were transferred to the Alpena hatchery, 20,000,000 were sent to Sault Ste. Marie, and 52,000,000 were shipped to other

fish commissions and private individuals. The balance were hatched at Detroit and produced 77,000,000 fry, which were liberated during the month of April.

On March 10 the Alpena hatchery was opened for the reception of 31,000,000 white-fish eggs and 1,000,000 lake-trout eggs, which had been sent to that point to be hatched and planted in Lake Huron. This work was superintended by Mr. Howard Mancha and was completed by May 5, when the station was closed.

In order to reduce the expense of distribution, and for the purpose of stocking Lake Superior, 20,000,000 white-fish eggs and 750,000 lake-trout eggs were transferred to the State fish-hatchery at Sault Ste. Marie, arrangements having been made with the State fish commission for its use from February 1. The white-fish hatched in May with a loss of 10 per cent, and were all planted in Lake Superior with the exception of 3,000,000, which were deposited in Lake Huron, near Detour. The lake-trout eggs yielded 700,000 fry, the loss amounting to only 50,000.

The water at this point during April ranged from 32° to 37° the average for the month being about 33½°. The average for the month of March was 32°. The water was shut off from the hatchery several times during the season, but, as it was only for short intervals, no apparent damage was done.

All the lake-trout eggs hatched by this commission at Alpena and Sault Ste. Marie were transferred from Northville, and the white-fish eggs were shipped from the Detroit River fisheries.

The following table shows the number of eggs collected at Northville and substations, and the number of eggs and fish shipped during the fiscal year, including accessions by transfer from other stations:

Species.	Eggs collected.	Eggs and fish shipped.
Lake trout	13,779,000	11,280,000
Brook trout	1,019,442	1,001,380
Loch Leven trout	103,800	71,026
Steelhead trout		132
Rainbow trout	83,850	72,026
Grayling		63
White-fish	203,560,000	177,495,000
Total	218,546,092	189,919,627

DULUTH STATION, MINNESOTA (S. P. WIRES, SUPERINTENDENT).

The hatching apparatus was overhauled and repaired during the summer, and a number of improvements to the station grounds were made, including the planting of a large number of willows and poplars and the completion of roads. Arrangements were also made with the water and light commissioners of Duluth to furnish the station with water from Lake Superior, this being very essential in hot weather for reducing the temperature of the river water.

The lake-trout work was commenced early in September, as usual, in the vicinity of Port Arthur and Rossport, Ontario; Grand Portage, Minn.; Isle Royale, Ontonagon, Copper Harbor, Montreal River, and Keystone, Mich. The spawning season opened in the vicinity of Port Arthur about September 20, and at the Michigan fields on October 5, eggs coming in from the various points up to and including November 30. The work resulted in the collection of 9,525,000 eggs, all but 3,000,000 of which were taken in Michigan waters. These were transferred to Duluth, and after being eyed 2,100,000 were shipped to the State fish commissioners of Utah, New York, Wyoming, and to stations of the U. S. Fish Commission, the total loss in transit on the entire number amounting to only 2,550. The eggs retained at the station hatched in April, and the distribution of the fry was made between May 2 and June 14.

In view of criticisms which have been made in the past year as to the methods employed in planting fry from this station, the following experiment was conducted: On the 4th of April 10,000 lake-trout fry, 2 days old, were transferred from one pail to another in dippers, each dipperful being allowed to fall 7 feet into a pail containing 6 inches of water. On the 15th this was repeated, the fall being increased to 9 feet, and again on May 5, with a fall of 12 feet. They were distributed the last of May in excellent condition, the total loss during the time they were held being 65. In view of these facts, it scarcely seems possible that the fry could be materially injured by planting from the deck of a vessel running at a moderate rate of speed with a fall of only 2 or 3 feet.

On the 20th of February 15,000,000 white-fish eggs were received from the Detroit hatchery. These hatched between April 20 and 25, yielding 14,600,000 fry, which were planted in Lake Superior at points in Wisconsin and Michigan. Consignments of brook trout and rainbow trout were also received in February, and were hatched with very small losses, the fry being distributed as usual during the month of June.

With the view to the collection of steelhead-trout eggs in the near future an investigation was made in streams tributary to Lake Superior, in which plants of that fish have been made in the past few years. From information gained from anglers in the vicinity it appears that during the past two seasons about 10,000 steelheads have been caught, their weight ranging from one-sixth of a pound to 8 pounds and their length from 6 to 25 inches. It was also learned that their spawning season in these streams commences about May 20. On account of lack of funds no effort was made to collect eggs this year, but 45,000 eyed eggs were received from the Oregon station in June; but as these had been six days en route, during very warm weather, they were of poor quality. The fry were hatched by June 21, and at the close of the year there were 34,290 on hand.

QUINCY STATION, ILLINOIS (S. P. BARTLETT, SUPERINTENDENT).

The prospects at the opening of the season seemed favorable for a large collection of bass and other fishes. They were particularly abundant in June, and as the river was falling rapidly it was believed and hoped that large numbers would be available for distribution; but on July 19, after several loads of fish had been sent to Mississippi and Indiana, a very heavy rain caused the overflow of the river and all of the ponds and lakes in the vicinity, scattering the fish all through the surrounding country and making it impossible to collect them in large numbers without incurring great expense. As soon as the river had subsided the steamer *Reindeer* was secured from the Illinois commission and vigorous efforts were made to accomplish the work laid out. The operations were very expensive, however, and the season closed before a great deal of the usual territory could be covered. Late in the fall several carloads of adult bass were collected and distributed. The output for the season amounted to 50,108 black bass (fry and adults), 13,345 crappie, and 72 warmouth bass, besides large numbers of the commoner species.

Work was resumed the following May. The services of a gasoline launch were procured, and by the end of June large numbers of fish had been collected and placed in the retaining pools at Meredosia.

MANCHESTER STATION, IOWA (R. S. JOHNSON, SUPERINTENDENT).

Various repairs were made to the buildings, ponds, grounds, and waterway during the spring and summer, the most important being the reconstruction in cement of the old dry wall along the spring branch, which had been seriously damaged by freshets. The new wall was made 1 foot higher than the old one, and the land behind it filled in correspondingly. A new roadway was constructed, which adds greatly to the appearance of the station. Heretofore the retaining tanks at Bellevue have been covered with a temporary shelter, which was taken down at the close of each season and stored with the other equipment, but this year it was decided to construct a permanent building over the tanks, the city council of Bellevue having granted free use of the land for that purpose. The building is a one-story frame structure, 50 by 16 feet, with an extreme height of 15 feet. It stands on a hillside and is supported by white-oak posts, which raise it 6 feet above the ground on the lower side, thus giving ample space under the building for the storage of boats and other large equipment. In one end there is an office and storeroom 8 by 16 feet. In the main portion, which is 42 feet long, are 6 wooden retaining-tanks, 12 feet by 4 feet by 3 feet, intended for holding young bass and crappie until ready for distribution. These tanks are supplied with water from the city works, conveyed through 1-inch pipes under a pressure of 100 pounds. The total cost of the structure was $439.39.

Fish-cultural work was conducted on the same general lines as in previous years, except that the propagation of black bass has been

discontinued entirely, the station depending on collections at Bellevue for its supply of this important fish. The large ponds formerly used for the bass work were devoted to the culture of brook and rainbow trout, with very gratifying results, the adult trout having a much wider range and being able to secure a large amount of natural food.

The brook-trout fry on hand at the beginning of the year numbered 30,800, of which 19,600 were distributed during the fall. The stock of breeders consisted of 1,810 two-year-olds and 500 adults. These fish have been kept in the old bass ponds for several months, and were in excellent condition. From the 487 ripe females available 173,920 eggs were secured, or an average of 359 per fish. They were of excellent quality, and hatched 98 per cent of strong, vigorous fry. On January 18th, 189,420 eyed eggs were received in good condition from Mr. H. F. Hurlbut, of East Freetown, Mass., and in February another lot of 50,000 came in from Leadville, with a loss of only 210. From these eggs, amounting to 413,340, 370,495 fry were hatched, 257,500 being distributed to applicants and planted in public waters during the spring, and 60,000 held for shipment in the fall.

The rainbow trout on hand in July were carried until fall, when 13,635 were distributed, the loss during this time being very slight. The breeders, consisting of 3,600 three-year-old and 1,340 four-year-old fish, yielded the first eggs on December 31, and collections continued until the end of March, 415,330 eggs being secured. The results were very disappointing, as only 588 ripe females were available. The fish are in excellent condition, though, and it is hoped that the yield next year will be considerably over a million. Of the eggs obtained, 126,000 were shipped to other stations and 206,155 were hatched, 124,000 fry being distributed during the spring and 75,000 held for fall distribution.

Between October 27 and November 24 the Loch Leven trout on hand yielded 4,680 eggs, an average of 520 per fish. From this lot 3,830 fry were hatched. The fry on hand at the beginning of the year were planted during the fall in the Maquoketa River, near Manchester, as there were no applicants for this fish.

Several of the 3-year-old grayling reared at the station produced eggs during April and May, but as no ripe males were found an effort was made to fertilize them with milt from the rainbow trout, but without success. Of the 5,000 fry on hand at the beginning of the year, 3,000 were planted in a stream near the station, the loss during the time they were held amounting to 2,000.

All of the brood trout and yearlings were kept as usual during the spring and summer in troughs and nursery ponds, their principal food throughout the year consisting of a mush made of beef liver and shorts boiled in varying proportions, according to the age of the fish, though a considerable amount of minnows and other live food, collected from streams in the vicinity, was utilized in this way.

Very heavy losses of trout occurred again during the spring from

the same disease that attacked them the previous year. On July 16 Mr. M. C. Marsh, who has been detailed to make a systematic study of fish diseases, visited the station for the purpose of investigating the cause of the diseased condition of the adult brook trout, and remained until August 1.

The rock-bass ponds were drawn on August 1, and 6,000 young were transferred to the hatching-troughs for distribution. The fish were not shipped until October 22 and during this time about 50 per cent of them were lost.

Several hundred adult fish were collected near the station during the fall, and early in April 118 of them were placed in Pond V and 117 in Pond Z. The fish were noticed spawning in May, and the first fry were discovered on June 15. As the ponds were not drawn down, no estimate could be made as to the result of the spawning.

On account of the excessive drought during the early spring and summer, and the consequent failure of the Mississippi River to overflow its banks, very little work was done at the Bellevue collecting station. Lakes and bayous from which thousands of young black bass and crappie had been taken the previous year were practically dry, and although a large extent of territory was covered only a small number of young fish could be secured. Work commenced on July 5 under the direction of Mr. Charles Hruby. Fishing continued from July 11 to September 1, during which time 16,089 black bass, 4,570 crappie, 829 yellow perch, 65 sun-fish, 300 pickerel, and 2,274 cat-fish were collected and delivered to the cars for distribution. Work was discontinued on September 1 and the station closed for the season.

During the spring of 1901 the station was opened and arrangements made to commence actual work on July 1.

Fish on hand at Manchester station at beginning of the year 1900–1901.

Species.	Calendar year in which fish were hatched.				
	1901.	1900.	1899.	1898.	1897.
Brook trout	60,000	560			649
Rainbow trout	75,000		2,840		1,140
Loch Leven trout	3,000		10		
Grayling			431		
Rock bass					235

Air temperatures at Manchester station during the year 1900–1901.

	Min.	Max.	Mean average.		Min.	Max.	Mean average.
1900.				1901.			
July	59	92	78	January	−10	48	24
August	68	95	83	February	−20	38	18
September	40	93	70	March	2	62	36
October	46	86	64	April	32	90	57
November	1	65	39	May	44	90	66
December	0	50	27	June	48	100	79

Water temperature constant at 50.

NEOSHO STATION, MISSOURI (H. D. DEAN, SUPERINTENDENT).

The fish on hand at the beginning of the year were carried until fall with comparatively light losses, and in October the distribution was commenced, the output amounting to 92,600 rainbow trout, 8,037 black bass, 9,345 rock bass, 300 crappie, 2,700 strawberry bass, and 5,730 bream.

At the approach of the spawning season the trout were transferred to breeding ponds, but although in excellent condition, the results were not satisfactory. Once a week the ponds were seined to prevent loss of eggs through the fish not entering the raceways, but despite this precaution the number secured was much smaller than usual. The first eggs were taken on December 10 and the last on March 12, the 655 fish available yielding 473,503, an average of 723 eggs per fish. Of these only 60 per cent were eyed. 184,032 were sent to other stations and to private applicants, and at the close of the year the stock of fingerlings on hand for fall distribution numbered 51,500.

Early in July the black-bass ponds were drawn and 10,968 young fish transferred to troughs placed in the branch stream; 74 per cent of this number were successfully distributed in October and November. With abundance of suitable food there seems to be little difficulty in holding black bass through the summer at this station. Provision was made during winter for separating the breeders from the young fish by partitioning off a small portion of the ponds with wire screens, through which the young might pass and thus escape the old ones. At the close of the year large numbers of young fish were in evidence, but none had been transferred from the ponds.

The ponds containing strawberry bass were not drawn until September, as it is difficult to handle these fish during warm weather without loss, and it was thought best to allow them to remain undisturbed until fall, but only 3,874 were found, and better results might possibly have been secured had the ponds been drawn earlier.

The breeding crappie, 38 in number, were transferred to the ponds in the spring, and for the first time it was possible to observe their spawning habits. Their nests were placed close together and not far from the banks of the pond, 18 nests occupying a space of not more than 10 by 15 feet. In the act of spawning the fish remain nearly stationary, their bellies close together, but their bodies at an angle so that their backs are separated 2 or 3 inches. They will lie this way, bodies quivering, for a few seconds, then separate and take a turn around the nest. Sometimes one fish will visit several nests in succession, but it could not be determined whether one fish spawned on more than one nest. The eggs are smaller than gold-fish eggs, and practically invisible unless drawn up in an examining tube. They hatch in about 50 hours, the fry being so small at first that they can hardly be seen in a pan of water. They are very active, but no screen is small enough to hold them, which explains why so many of them

have been found in ponds below the breeding ponds. It could not be determined just how long the young remain on the nests after hatching, but parent fish watch the nest very closely for two weeks or more. It is not certain which parent watches the nest, but they show more vigilance than either the rock bass or the black bass, sometimes biting at the glass tube when it is put down to take up fish or eggs for examination. The water temperature in this pond ranged from 60° to 65° during the spawning season. Nests were observed on April 27, and the first eggs were taken up for examination on May 13.

The rock-bass work of the past season was very disappointing, as for some unknown cause only 9,345 were secured from the ponds. The breeders were placed in three ponds during the spring of 1901, and as large numbers of nests were occupied and many fry have been observed, it is thought that the results will be much better this season.

Sun-fish appeared in large numbers in the ponds during the spring, and thousands of them were used for bass food; 5,730 were also distributed to applicants.

After the ponds were drawn down in the fall ponds Nos. 1, 2, 3, and 4 were entirely rebuilt, and a number of others were materially improved. A cement walk, over 1,000 feet long, from the residence to the small gate on the north side of the grounds, was constructed, and two fine cement bridges over the branch were built. This work has improved the appearance of the station very much.

Congress having made a special appropriation of $7,500 for reconstructing the hatchery and acquiring land for bass ponds and an additional water supply, steps were taken to purchase the necessary land and to assemble the material for the work of construction.

Number of fish on hand at Neosho at the end of the year.

Species.	Calendar year in which fish were hatched.				
	1901.	1900.	1899.	1898.	1897.
Rainbow trout	51,500	1,500	2,275	940	.....
Black bass	.....	.....	133	.....	155
Rock bass	.....	.....	177	.....	40
Strawberry bass	.....	.....	105	.....	55
Golden ide	.....	.....	.....	.....	11
Total	51,500	1,500	2,690	940	261

Temperature and precipitation at Neosho for the year ending June 30, 1901.

Month.	Max.	Min.	Mean.	Precipitation.	Snow.	Month.	Max.	Min.	Mean.	Precipitation.	Snow.
1900.	°F.	°F.	°F.	Inches.	Inches.	1901.	°F.	°F.	°F.	Inches.	Inches.
July	92	50	75.4	4.65	.....	January	70	9	38.9	0.45	.....
August	98	57	77.7	3.50	.....	February	64	12	34.4	1.20	2
September	94	47	73	10.57	.....	March	82	6	46.6	4.54	2
October	88	33	52.6	4.02	.....	April	86	28	54.4	3.12	1
November	78	16	48	3.13	.....	May	85	36	63.9	2.62	.....
December	64	9	38.4	.68	.....	June	98	45	77	1.31	.....

Mean temperature for year, 57.5° F. Total precipitation, 39.79 inches.

SAN MARCOS STATION, TEXAS (J. L. LEARY, SUPERINTENDENT).

To prevent a repetition of the loss of fish and damage to property caused by the overflow of the San Marcos River in 1900 a special appropriation was obtained for the construction of a protection wall along its banks. During the month of August a stone wall 246 feet long and 6½ feet high was built of white limestone, laid loose, 2½ feet at base and 14 inches on top. This work was commenced August 20 and was completed by October 5, at a cost of about $640. A concrete walk 1,200 feet long, 4 feet wide, and gravel walks 400 feet long, 4 feet wide, were laid from the residence to the office, and a number of minor improvements were made to the ponds and buildings.

It became necessary during the year to obtain additional brood fish, as many had been lost during the freshet above referred to. By seining the Blanco and San Marcos rivers 150 black bass were secured and transferred to the station in excellent condition. With the approach of the spawning season they were placed in the spawning-ponds, 24 fish being allowed for each half acre. This number is considered ample for that area, as in stocking bass ponds care should be taken not to allot too many breeders to a pond, it being better to have too few rather than too many. Nesting commenced on January 31, and by February 8 young fish were seen. This unusually early spawning was undoubtedly due to the very mild winter and to the direct flow of water from the artesian well, the temperature of which was 68°. Owing to a sudden cold change late in February, however, nearly all the eggs and fry in the pond at that time were lost. The last nest was noticed on June 17. The majority of the bass still deposit their eggs on the clay banks of the ponds, though the number taking the piles of gravel provided for this purpose is increasing annually.

The transfer of fry from ponds to distributing tanks commenced in April and continued to the end of June, 89,600 young being handled during this period. In making transfers a seine of bobbinet is used, and no fry under 1½ inches in length are removed from the ponds.

No change has been made in the method of feeding, the flesh of crawfish and fish ground very fine and then screened through a fine sieve being the principal material. When they could be obtained water fleas were given for a change in diet, and as the fry became older large numbers of small minnows were fed them. The brood-fish are always fed regularly throughout the spawning season, as it not only keeps them in good condition, but tends to tame them and allows opportunity for close observation.

Of the rock bass brought from Neosho six remain. These, with the 17 yearlings saved from the flood, were placed in a breeding pond in the spring, and at the close of the year many thousand young were visible. They commenced spawning about the middle of March, and nests were noticed as late as June 22.

The strawberry bass transferred from the same station also suffered heavy losses, though the six remaining of this lot are in fine

condition. They commenced spawning late in March, and it is expected that there will be a considerable number of young available for distribution. This fish is much more hardy than the crappie and, unlike it, will thrive in clear water.

The breeding crappie were placed in a pond about an acre in area, together with 26 adult carp for keeping the water in a slightly muddy condition, which is apparently essential in the propagation of this species. About the middle of June a haul of the seine in this pond resulted in the capture of nearly 1,000 fry 2 to 3 inches long. Crappie were also placed in several other ponds and tanks in the vicinity, but owing to the drought the water in them dried up and the fish had to be removed. The spawning season of crappie at this station extends from the latter part of March to midsummer, and under favorable conditions fish from 12 to 16 months old will spawn during the fall.

The bream, of which there are 45 adults, have proven very productive, grow rapidly, and are especially well adapted for small ponds. They were placed in Pond P in March and commenced spawning in April. A peculiarity of these fish is that their spawning extends throughout the entire summer and early fall.

As usual, a great deal of attention has been paid to providing the various forms of fish food. Carp and mud shad were cultivated for the black bass and crappie, and shrimp (*Crangon vulgaris*) have been introduced in the ponds containing bass and bream, and this year furnished a large amount of excellent food for the adults and young. During the summer shrimp in large numbers and an occasional salamander came up from the artesian well.

Many aquatic birds, snakes, and turtles have been killed, the ponds proving an especially great attraction to wild ducks of different varieties during the winter. Crawfish and bullfrogs were also very numerous and furnished a valuable supply of food for the fry.

The station has been very free from diseases of all kinds until this year, when fungus attacked a lot of 1,000 crappie transferred from a pond in the vicinity. The water in this pond was quite muddy and the temperature high, and fungus made its appearance very shortly after their transfer to the station in water at 75°. During the spring fungus also developed in the five ponds supplied by the artesian well, killing a number of the adult black bass and about 30,000 young before it could be checked. This was believed to have been caused by the cold weather killing the upper portion of the very dense growth of water plants, and partly also to the poor circulation of the water, the flow from the artesian well being very light during that period. The plants were all cut out of the ponds, and while the water was very low salt was applied, about half a pint for each square foot of surface at the bottom and sides being allowed. The fish were also taken out and immersed in a bath of strong brine. Though very seriously affected, they commenced to improve at once under this treatment. and the fungus disappeared in a very short time.

The station furnished for distribution during the year 89,985 black bass, 12,770 crappie, 8,090 rock bass, and 7,595 bream. The distribution was made by the station employees, and extended from July 2 to October 3, 1900. It was again resumed the following May and continued to the close of the fiscal year, the total cost of this branch of the work amounting to $778.06. In making this distribution 36,162 miles were traveled, 31,555 of which were free and 4,607 paid.

With few exceptions the railroads of the State not only furnished free transportation, but rendered every assistance possible to the employees engaged in the work. To the officers of the International and Great Northern Railroad special thanks are due for courtesies.

LEADVILLE STATION, COLORADO (E. A. TULIAN, SUPERINTENDENT).

From December 20 to June 1 the superintendent was absent from the station, his duties being performed by the foreman.

At the commencement of the fiscal year there were on hand 500,000 fingerling brook trout, 270,000 of which were planted in July, 10,000 in August, and 28,000 in October, the losses during this time being about 38 per cent.

The usual arrangements were made for the collection of brook-trout eggs in the fall from lakes belonging to private individuals, and the results of the work are embodied in the following statement:

Source of supply.	Spawning season.	Eggs collected.	Loss.	Fry hatched.	Eggs shipped.
			Per cent.		
Station brood fish	Oct. 10–Dec. 7	272,700	47.5		142,100
Uneva Lake	Nov. 1–Nov. 25	275,900	48.5	143,300	
Smith's Pond	Oct. 24–Nov. 17	156,900	30	109,000	
Ridgway's Pond	Nov. 16–Nov. 29	569,800	9.8	514,800	
Wellington Lake	Oct. 31–Nov. 24	1,818,400	48	675,000	267,900
Young's Pond	Oct. 25–Nov. 11	610,000	21.1	481,500	
Decker's Pond	Dec. 11	116,600	70.6	32,000	
Musgrove's Pond	Oct. 23–Nov. 30	454,500	44.6	251,500	
Derry's Pond	Oct. 28–Nov. 28	439,000	40	274,000	
Black Lake	Nov. 17	46,000	81.5	8,500	
Total		4,759,800		2,489,600	410,000

On May 20, when all the eggs had been hatched, there were on hand 1,995,000 brook-trout fry, 887,300 of which belonged to the Commission and 1,107,700 to the parties who had furnished the eggs. Between this time and the end of the fiscal year 41,000 of those belonging to the Commission, or 4.5 per cent, were lost and 585,000 were planted, leaving on hand 260,800.

Last year it was believed that the heavy loss of brook-trout eggs was largely due to their having been derived from 2-year-old fish, and the results this year seemed to confirm this theory, as the loss on each lot, except those taken from the brood-fish at the station and the Uneva Lake fish, was from 10 to 60 per cent less than last year. On the station eggs the loss was 2 per cent greater than the previous year, but this was attributed to the fact that the stock is getting very old. The loss on the Uneva Lake eggs, however, was 38 per cent

greater than last year, and this is inexplicable, unless it was due to close inbreeding of the trout for the past eight years, or to the fact that nearly all of the trout were caught out of the small lakes early in the season and held in ponds in a somewhat crowded condition, and were injured by frequent handlings. There is no doubt that much handling of the fish injures the quality of the eggs, hence the greatest care is exercised in collecting and in fertilizing them.

Shipments of eyed brook-trout eggs, aggregating 410,000, were made to other stations of the Commission, State fish commissions, and private hatcheries, and with one exception they reached destination in excellent condition, the loss en route ranging from 33 to 600 eggs on shipments of 25,000. The exception referred to was a consignment to Tokyo, Japan, which hatched en route because the ice chamber in the top of the case was not kept filled with ice.

On July 1 there were 120 three-year-old Loch Leven trout in stock, but 52 died during the year, and the bulk of the 2,000 fry on hand at that time were also lost. The only eggs of this species collected were 20,700, taken at Uneva Lake on November 25; of these 6,700 died and the remainder were hatched, half the resulting fry going to the owner of the lake. At the close of the year there were 5,790 fingerlings on hand.

The rainbow-trout work in Colorado is very discouraging, notwithstanding the fact that the few planted in the streams of the State by the Commission and the State commission have done exceptionally well. Nearly all of the eggs collected this year from the fish at the station were lost, and out of a collection of 25,000 obtained at Lake Loveland on March 27, only 6,000 were saved. These were shipped to Buffalo, reaching destination in excellent condition, and were hatched in the Fish Commission exhibit. In February 50,000 eggs were received from Manchester station and hatched with a loss of 10,000. During May and June 17,000 fingerlings were planted, and at the close of the year there were 6,795 on hand.

The 21,400 lake trout on hand, resulting from eggs shipped from Northville and Duluth, were planted in suitable lakes in Colorado during the months of July, August, September, and October.

The steelhead fry from eggs shipped from Rogue River, Oregon, in May, were planted in August and September, with a loss of only 800.

The collection of black-spotted trout eggs continued into July, but at the beginning of the year there were 1,881,300 on hand. They finished hatching early in August, with a loss of 131,800, or about 7 per cent, and the loss of fry up to the middle of August was 11.5 per cent. The owner of the Grand Mesa lakes received 310,000 fry as his share, and the remaining 1,231,000 were the property of the Commission; 820,000 of these were planted in September and 360,000 in October, with a loss of about 4 per cent of fry, making a total loss of only about 25 per cent on the entire collection of eggs obtained at the Grand Mesa lakes.

These eggs are obtained under very adverse conditions, as they must be hauled 35 miles over the roughest kind of mountain road and then transferred by rail a distance of 230 miles, with the thermometer ranging from 100° to 110° in the shade. During June, 1,317,000 eggs were collected at these lakes and taken to Leadville. The loss on them to the close of the year was 1,800, or about 0.12 per cent.

The fish and fry on hand at the close of the year is shown by the following table:

Species.	Calendar year in which fish were hatched.				
	1901.	1900.	1899.	1898.	1897.
Brook trout	260,800				65
Loch Leven trout	5,790	410			68
Black-spotted trout					21
Rainbow trout	6,795	1,525			
Grayling				76	

SPEARFISH STATION, SOUTH DAKOTA (D. C. BOOTH, SUPERINTENDENT).

During the summer the special appropriation of $3,500 was expended in improving the grounds, building ponds, constructing a storm channel for protecting the lower grounds from flood, and laying a 4-inch iron pipe from the upper spring to the hatchery, a distance of 700 feet.

The fish reared at the station were distributed in the fall to applicants in South Dakota, Wyoming, and Montana, the output being 210,000 brook trout and 10,000 Loch Leven trout.

With the approach of fall arrangements were made, as in previous years, for collecting eggs of the brook and Loch Leven trout from public and private waters in South Dakota and Wyoming, and a temporary station for eying eggs was established at Sand Creek, Wyoming. Several thousand trout about 10 inches in length were handled here, yielding 302,200 eggs, which after being eyed were transferred to Spearfish. The water temperature at this creek stands uniformly at 54° F. throughout the year, so that the eggs were ready for shipment in 28 days. Collections were also obtained from ponds controlled by private individuals, and these, with the eggs produced by the brood fish at the station, gave a total collection of 1,062,650 brook-trout eggs and 50,470 Loch Leven eggs.

Of the brook-trout eggs, 201,000 were shipped as follows: 100,000 to Bozeman, Mont.; 50,000 to Duluth, Minn.; 51,000 to the Wyoming Fish Commission. The rest were hatched at the station and produced 654,000 fry, of which 250,000 were returned to the owners of the brood stock. On the remaining 408,000 there was a loss during the spring of 133,000, and 195,000 were planted in waters of South Dakota, leaving 80,000 on hand at the close of the year.

The Fish Commission's share of Loch Leven trout eggs amounted to 36,100. These were hatched and 30,000 young fish were distributed during the spring, leaving 5,000 on hand at the close of the year.

During the winter arrangements were made with Mr. S. H. Campbell, the superintendent of the Wyoming commission, for the collection of rainbow-trout eggs on Laramie River. Several hundred large rainbow trout were secured about 24 miles southwest of Laramie and placed in retaining-ponds, but a sudden rise of the river washed away the pond and the fish escaped, but in the meantime 25,000 eggs had been secured. These were transferred to the station and produced 18,500 fry.

At the request of the acting superintendent of the Yellowstone National Park, arrangements were made in April for an investigation of the trout streams, with the view to the establishment of a substation for the hatching of trout. Accordingly, the superintendent examined the Gardiner River and Lupine, Lava, and Glen creeks, but owing to the large number of bowlders and the swift, strong current, which prevented the use of a seine, it was found impracticable to operate at any of these points. Accompanied by an escort of six men, a trip was made through the park in the attempt to secure rainbow trout in the Gibbon River from Norris Basin to a point a mile above the Virginia Cascades, but none was captured, though a fisherman was seen with two small ones taken from the cascades.

The trip was continued to Grand Canyon and a camp was made on May 18 at the mouth of the Otter Creek along the Yellowstone River, where the first fish of the season had been captured on May 15 by Lieutenant Amos. Seining operations were conducted for several days in the Yellowstone and hundreds of *Salmo mykiss* taken. These, however, were found to be affected by parasites and not very gamy. As soon as the road crew could shovel out the road, which was full of snow, the trip was continued to Yellowstone Lake, where the small streams entering the lake from the west were found to abound in trout. Four troughs were constructed, and after building a reservoir 300,000 eggs were taken and placed upon the trays. An investigation was then made of all the streams entering the lake from the lake outlet to West Thumb Bay, with the view of obtaining a more central point for establishing an egg-eying station, and it resulted in the selection of a site 2 miles north of West Thumb Station, on a stream not over 5 feet wide, but containing a sufficient supply of water of good quality. This stream was alive with *Salmo mykiss*, averaging 15 inches in length and weighing about 1¼ pounds. Sufficient trough capacity for eying 2,000,000 eggs was provided, and after building a substantial dam and flumes, the fish were caught and eggs taken. Fish were so plentiful that they were frequently taken with the hands in the shallow water. By the 30th of June 1,200,000 eggs had been taken and placed on trays at this station.

Nearly all of the small streams entering the lake are full of *Salmo mykiss*, and it is recommended that the Commission cooperate with the commanding officer in erecting a building at or near West Thumb for the collection and hatching of black-spotted trout eggs, as it is believed that 5,000,000 could be taken each season.

BOZEMAN STATION, MONTANA (JAMES A. HENSHALL, SUPERINTENDENT).

In August and September the fish that had been carried through the summer were shipped to applicants in Montana, Idaho, Oregon, and Washington, the distribution being made principally by one of the cars.

In November 108,000 brook-trout eggs were collected from the brood fish at the station. In addition to these, 100,000 were received from Spearfish, S. Dak., and 88,000 from Leadville, Colo., making a total of 296,000. During the spring it became necessary to remove the fry hatched from these eggs to the nursery ponds, in order to make room for the grayling and native-trout eggs, and the consequent loss was considerable, but the fingerlings on hand at the close of the year were healthy and growing rapidly.

The eastern brook trout at this station are subject to a peculiar disease when they reach the age of two years, and at spawning time it is very pronounced. It commences with the formation of encysted tumors on the lower jaw, usually at the end of the mandible; this is succeeded by a slimy condition of the entire body in some cases, with engorgement of the gills, though in others the fish seem to be quite normal with the exception of the tumors. All the specimens affected have died, about 30 per cent of the 2 and 3 year old fish having been lost. As no other species has been similarly affected it is thought that the disease is inherent and not due to local conditions.

During the winter the usual arrangements were made for collecting eggs of the native trout at Henry Lake, Idaho, and grayling eggs at Redrock, Mont. The season at the former place did not result as successfully as heretofore, only 730,000 eggs being secured, as against 1,440,000 in the season of 1900. This was attributed to scarcity of fish, 50 tons of trout having been taken from the lake and shipped the previous winter. The station was opened on April 4, and the first eggs were taken on April 22. The 592 fish handled yielded an average of 1,235 eggs. About 370,000 of the eggs were transferred to Bozeman, 150,000 were shipped to other points, and 115,000 fry were hatched and planted at the lake. The last eggs were taken at this place on June 3.

At Redrock Lake, where Mr. G. H. Tolbert was in charge, a new and larger trap was put in lower down the creek and a new dam was built. On account of the cold backward season, the run of grayling commenced later than usual, but the fish were very numerous, and it is probable that twice as many eggs as were taken might have been secured had it been desired. Operations at this point began April 4th and closed June 21st, 2,400,000 eggs being secured. From these, 1,362,300 fry were hatched and planted in the lake and its tributaries, 526,000 eggs were transferred to Bozeman, and 390,000 were shipped to other points. The spawning season lasted from May 11 to May 23.

The eggs transferred to Bozeman hatched between June 7 and 29, producing 293,000 fry, an unusually good percentage.

If the washings from an emulsion of fresh liver are fed to the fry

while they are yet in the hatching-troughs and before the absorption of the yolk sac, it has been found that they can be removed to the nursery ponds as soon as they begin to swim and that their physical condition is improved. This food is placed in the aerating tray at the head of the trough, and soon finds its way to the fry at the bottom.

A collection of 33,000 steelhead eggs was made from the four-year-old fish confined at the station and from a few captured in Bridger Creek. Of these, 12,000 were sent to the Pan-American Exposition at Buffalo; the rest were hatched at the station, and at the end of the year there were 6,600 fingerlings on hand.

The following table shows the number of fish and eggs of all kinds on hand on June 30, 1901:

Species.	Calendar year in which fish were hatched.				
	1901.	1900.	1899.	1898.	1897.
Brook trout	202,000	-------	-------	637	489
Black-spotted trout	*293,000	-------	-------	3,691	119
Steelhead trout	6,600	-------	-------	149	2,030
Rainbow trout	-------	-------	1,600	-------	-------
Grayling	293,835	-------	50	-------	-------
Total	795,481	-------	1,650	4,477	2,638

* Eggs and fry.

There was but very little rainfall during the summer of 1900 and a lack of snow the previous winter, consequently the mountain streams were much diminished and the supply of water in the reservoirs was considerably lessened; but, by utilizing the creek water as far as possible, no great inconvenience was experienced. In order that the work of the station be not jeopardized by an insufficient water supply, a connection was made between the creek water pond and the main supply pipe from the spring reservoirs, by a 12-inch wooden pipe. With this arrangement either spring or creek water can be used for the hatchery and ponds. The creek water is perfectly clear for nine months in the year, and never exceeds 60° F.; hence it is really preferable to the spring water after the eggs are hatched, as it contains plenty of food and air, in which the spring water is entirely deficient. In using the creek water in winter, it can be tempered by the water from the warm spring, which has a uniform temperature of 77°; accordingly the spring has been partly inclosed by a wall, which it is proposed to carry to a height of 4½ feet, whereby the warm water can be flumed into the creek water ditch and thus prevent its freezing in winter.

BAIRD STATION, CALIFORNIA (G. H. LAMBSON, SUPERINTENDENT).

At the beginning of the fiscal year the racks were in place and the river closed to the ascent of salmon above the station. Numerous repairs were made to the buildings, a new spawning-house was constructed, and provision was made for canning salmon as fish food.

Experimental hauls of the seine early in August showed that the run of salmon was very light. On the 18th, in four hauls, nine ripe females were secured, and on the next day 36,000 eggs were taken. Fishing continued until the 22d of September, during which time 215 hauls of the seine were made, 4,588 females and 3,633 males being captured. Of the females 520 proved ripe and yielded 2,021,000 eggs, 517 males being used in fertilizing them. The fish averaged 3,887 eggs each, much less than those of the previous year, which averaged about 5,000. The fall run of salmon was very light and no ripe fish were taken in the seine, though several hauls were made at intervals during the season. From traps in the upper rack 26 ripe fish were collected, which yielded 118,500 eggs, an average of 4,557.

The practice of killing the salmon before spawning was not followed, as it causes the loss of large lots of eggs. Fully 10 per cent of the females impounded early in the season, and 5 per cent during the latter part, were not sufficiently ripened, though eggs were pressed from them when taken from the seine. If the fish killed prove to be unripe, the entire lot of eggs is lost; but it requires as much time and trouble to try them as to accomplish the work of spawning. When there are only a few salmon on hand and an abundance of time, they are killed before stripping, if there is no doubt as to their being ripe; but where large numbers are to be handled this method should not be employed.

The eggs were fertilized in the same way as last season—that is, the pan in which they were to be caught was dipped in water and moistened; the eggs and milt were then taken simultaneously and mixed thoroughly with a feather or the hand. About half a pint of water was then added and the eggs again stirred, after which they were washed and poured into a large bucket, where they were left until the eggs separated. After becoming free they were placed in baskets in the hatchery, 25,000 to the basket, it having been found that they do better allotted in this way than by putting 40,000 to the basket, as formerly. All of the eggs except 8 baskets were picked or washed throughout the time of incubation including the tender stage, and with very successful results compared with the 8 baskets which were kept covered during that time, the experiment seeming to demonstrate that constant picking and washing improves them to some extent.

All of the eggs from the first run were transferred to the California Fish Commission hatchery at Sisson, and arrived in good condition.

Besides the eggs collected in the fall, 1,000,000 were received from Battle Creek, making a total of 1,118,500 left in the hatchery. Of these, 25,000 were shipped to Mr. L. Z. Leiter, Lake Geneva, Wis., and 1,000 to Professor Dudley, of Stanford University. Those retained commenced hatching November 28, and by February 16 they were all out. Of the 1,056,250 fry hatched, 166,680 were lost. The others were planted in the McCloud River between March 15 and May 18.

During the fall several attempts were made to can salmon as fish

food before a successful solution of the problem was reached. A number of fish received from Battle Creek on December 7 were canned on the 8th, the whole fish being used, including head, tail, fins, and backbone, the contents filling 41 five-pound cans. These were found in good condition when opened two months later, and they probably would have kept indefinitely. This material was given to the fry during December, January, and February, but it did not prove a very satisfactory food, as it was very difficult to divide it properly for the young fish. If ground very fine, it would wash away in the water, and if given in coarse pieces many of the fish would choke and a heavy death rate followed. It is thought that the difficulty may be overcome in future by rejecting the bones, heads, and fins. As the fry became older they took this food readily and seemed to thrive on it, but, as the quantity canned was too small, it was soon consumed, and it became necessary to procure a supply of liver, which, mixed with shorts, was fed to the close of the season, except for a period of two weeks when it was impossible to secure liver, and goat meat was used. This proved very unsatisfactory.

At the request of Hon. W. T. Glascow, the secretary of the marine department, Wellington, New Zealand, the superintendent of Baird station was detailed to take an assignment of 500,000 quinnat-salmon eggs to the New Zealand government. He sailed from San Francisco on December 13 with 14 boxes, each $2\frac{5}{6}$ feet long, $1\frac{2}{3}$ feet wide, and 2 feet high, the weight of each package being about 230 pounds. The passage was very rough, but considering the difficulties under which the eggs were taken, the length of time en route (31 days), and the 7,059 miles traveled, the shipment was regarded as successful. The total number of eggs lost was 57,500. It was impossible to remove dead eggs, as in the poor light they could hardly be distinguished from the good ones. When such an attempt was made, the fungus was found to have taken such a firm hold on the wire bottoms of the screens that it broke into smaller particles, which, coming into contact with the good eggs, caused it to spread. All attempts at removal were therefore abandoned and an effort was made to prevent its spread by keeping the temperature as low as possible. It is thought the fungus started at Honolulu, where the eggs were exposed to a temperature of 48° for about nine hours, while the freight in the cold room was being unloaded. A quantity of vegetables stored in the cold room with the eggs may have helped in developing the fungus. In loading the cases on the steamer they were raised from the dock and lowered into the ship by slings, five cases at a time, and frequently they were almost on end. This was also done at Honolulu, when removing the eggs, in order to unload freight. In many of the cases the eggs had all jolted to one end, and as the dead and unimpregnated eggs were rather soft, many were broken, thus giving the fungus every possible chance for growth.

While the eggs were in the cold room no ice was used in the cases,

as the temperature was so low that there would have been but little meltage and eggs could not be kept moist by this means. Instead of this the eggs were watered every day after leaving Honolulu, care being taken to have the water of the same temperature as the room. This water was taken aboard ship at San Franciso and Honolulu and no condensed water was used. The isolated car used for transporting the eggs from Littleton to Kurow was a freight car with double walls for keeping out the heat. Ice was packed in the car with the eggs and on arrival at Kurow the interior of the car was cold and a large proportion of the ice remained. As the eggs arrived in New Zealand during the extremely warm weather of summer, it is not thought that they could have been safely transported without this car, as it is a 12-hour journey from Littleton to Kurow. Only three times during the trip did the temperature of the eggs get above 37° or below 35°—once on December 22, when it was 48°, and once on December 26, when it was 42°; on the 29th it fell to 32°. At such times the temperature was either lowered or raised until it was at 36°, the temperature maintained during the trip. In making the trip the eggs were loaded and unloaded 15 times, and though great care was exercised, they received at times some very hard jolts.

Battle Creek Station, California (G. H. Lambson, Superintendent).

A rack was constructed in August under the direction of Mr. Ledgerwood, and the two retaining racks were placed in position by the middle of the month, so that no salmon could ascend the stream. The station was then left in charge of a watchman until September 23, when the force reported and work was commenced on the ditch and flume. It was found necessary to place new flumes and to make a number of improvements to the mess-house.

As very few fish were noticed in the stream in October, an examination of the mouth of the creek was made, and it was found that a sandbar had formed across it near the site of the old racks, which caused the water to pass through Cottonwood Slough and lessened the flow in the regular channel. The bar was partially removed and the water restored to the old channel. On October 12 a number of hauls of the seine were made and 11 ripe fish were secured. Fishing continued throughout the month whenever the number of fish in the pool warranted, and as a result 865,500 eggs were obtained, though many were of poor quality, owing to long confinement of the fish.

In November fishing was irregular, as the run continued very light, though reports from the Lower Sacramento indicated that the run below Red Bluff was larger than it had been for years. To ascertain the whereabouts of the fish and to learn the cause of their not ascending as far as Battle Creek, two men were sent to make investigations. They found that the river from Battle Creek to Red Bluff was almost barren of salmon, but that the stream from Red Bluff to Tehama was full, the number increasing the lower they went. They also found

that large numbers were spawning on the gravel bars and riffles in that part of the river. This was thought to have been due to the low water for the past several seasons forming good spawning-grounds in the main bed of the river.

In November 2,216,000 eggs were collected and 438,600 in December, a total of 3,520,100 for the season.

A heavy storm occurred during the fall and caused considerable damage, washing out auxiliary racks, spawning weirs, etc., and carrying away about 12 feet of the bank at the east end of the rack.

Of the eggs collected, 461,640 were lost in incubation, several minor shipments were made to the Stockton High School, and 3,079,660 were transferred to the Sisson hatchery of the California commission and to Baird station, including 500,000 sent to New Zealand.

Clackamas Station, Oregon (E. N. Carter, Superintendent).

It having been decided to move the Clackamas station on account of the insufficient supply and poor quality of the water at the old site, a point down the Clackamas River, with a good supply of spring water, was selected during the month of July and the work of constructing a new station was commenced. A hatchery 42 feet by 80 feet, a bunk-house 30 feet by 42 feet, a stable, and other necessary buildings were erected, and by the end of September the station was in readiness for operating. The necessary roadways, bridges, etc., were provided, and all equipment that was of value was moved from the old station, which was then abandoned and left in charge of a watchman at a nominal salary.

At the beginning of the year an effort was made to tag about 1,600 quinnat-salmon fingerlings, but the experiment was a failure, and the fry were marked by clipping the adipose and the upper portion of the caudal fins. This method of marking seemed necessary in order that the fish might be distinguished from a lot of 5,000 marked in 1896.

Preparations were made early in October to receive salmon eggs taken on the Clackamas River by G. H. Oldenburg, which were delivered at the hatchery at 40 cents per 1,000 eyed. From this source 1,725,000 were derived. There were also transferred from the Little White Salmon 3,327,000, making a total of 5,049,000 salmon eggs handled at the station. They arrived in excellent condition and were eyed and hatched with a loss of 429,628. The fry were strong and healthy and commenced feeding about the latter part of December, when they were placed in troughs, 8,000 to each trough. By the end of January all of these fry were swimming and taking food, which consisted of canned salmon of a cheap variety, such as dog salmon, chippings from the gang knives used in canneries, etc. The salmon was put up in gallon cans for the Fish Commission, and was donated by the following-named firms, the cans having been furnished free of charge through the courtesy of Mr. F. P. Kendall, superintendent of the Pacific Sheet Metal Works, of Astoria, Oreg.; J. G. Megler & Co.,

of Brookfield, Wash.; A. Booth & Co., G. W. Sanborne, Columbia River Packers' Association, and Union Fishermen's Cooperative Company, Astoria, Oreg.; F. M. Warren and Mr. Farrell, of Portland, Oreg. This food was fresh and in good condition and the fry throve on it, but owing to the lateness of the season only about 1,000 pounds could be had, and it became necessary to purchase 2,880 one-pound cans of dog salmon. Shortly after commencing the feeding of this food a disease broke out among the fry, causing heavy losses. The fattest and oldest fry died, though they were apparently sound. This disease was undoubtedly due to the food. When first affected the fry would dart back and forth in the troughs as if seeking escape, but after 24 hours they became too weak for further effort and were drawn down against the screen, where they soon died.

Various experiments were tried with canned salmon, in the hope of continuing its use as fish food, but without success. Shortly afterwards the use of liver was begun, and the disease above referred to disappeared. Liver mixed with mush in varying proportions, according to the age of the fry, and seasoned with a small quantity of salt, proved satisfactory and about as cheap in the long run as canned salmon. The mush is a mill product known as "germea," commonly used as breakfast food; it costs nearly twice as much as middlings, but is a stronger and better food. Mixed with ground liver, it separates readily in water and can easily be taken by the smaller fry.

The fry were held as long as possible and were then planted at selected places, where the progress of their growth might be noted as far as possible. It is, of course, to be regretted that it is necessary to plant fry under 2 inches in length, but this is unavoidable owing to the immense amount of space that would be required for the rearing of millions.

With the exception of the affection due to the feeding of canned salmon, there was very little disease among the fry. In the winter, though, there appeared on the yolk sacs of about 1,500 fry what was supposed to be small air-bubbles, about the size of a pea, which held the fry to the surface of the water. They seemed to have no connection with the vital portion of the sac, however, as when pricked with a needle the bubbles would collapse and the fish would return to the water apparently none the worse from the operation. Upon applying a lighted match to the bubbles they would burst with a sharp report, indicating that they were filled with hydrogen gas only. Frequent and strong salt-water baths during the rearing period go far toward keeping the fry in a healthy condition.

In rearing the fry a tank 2 feet deep, 3 feet wide, and 12 feet long, which had been built for the purpose of hatching white-fish, was utilized for carrying about 10,000. The result was very satisfactory, as the fry had a greater depth of water in this receptacle and more room in which to move about, and it can be easily and quickly cleaned. The floor space occupied is also much less than would be required for

four 16-foot troughs, which would safely accommodate only 8,400. It is therefore recommended that tanks be substituted.

During the winter 1,000,000 white-fish eggs were received from Northville and 200,000 lake-trout eggs from Duluth, all of which were hatched and planted in lakes near Tacoma, Wash. From Leadville 100,000 brook-trout eggs were received, which produced 80,000 fry. Of these, 10,000 were planted in Cox Creek, Oregon, and the balance held at the station for rearing. The same number of grayling eggs, transferred from Bozeman, were hatched with a loss of only 8,839, and the fry were planted in the vicinity of Pendleton and Union, Oreg., at the request of the Oregon Fish and Game Association. During the spring the California commission furnished the station with 25,000 rainbow-trout eggs, which produced 23,291 fry. Of these, 5,000 were planted as fry and the remainder are on hand at the close of the year.

ROGUE RIVER STATION, OREGON (E. N. CARTER, SUPERINTENDENT).

During the first part of the year $1,000 was expended in constructions and improvements, the money being furnished by Mr. R. D. Hume, of San Francisco. A residence for the fish-culturist in charge of the station, Mr. J. W. Berrian, and an additional hatching-house, 24 feet by 70 feet, were erected; the grounds around the station were inclosed by a substantial fence. Provision was also made for procuring an increased supply of water from Rogue River, a pump-house being provided, in which a boiler and two small engines were placed, with two centrifugal pumps capable of throwing 600 gallons of water per minute each. In order to reduce the cost of pumping water a tank 20 feet wide, 48 feet long, 10 feet deep, capable of holding 72,000 gallons of water, was also constructed. This can be filled in a very short time by the pumps, and in addition to saving a large amount of fuel, it now requires the services of only one engineer where three were formerly employed. An investigation was made with the view to taking water from the Rogue River through a ditch, but owing to the expense the project was abandoned.

A rack was thrown across the river to stop the ascent of salmon, and by the end of October, when work had to be discontinued on account of high water, 3,303,000 eggs had been secured. Of these, over 500,000 were taken 15 miles below the station with drift gill nets.

An attempt was made to transfer the eggs while green, but those so treated proved almost a total loss, and it became necessary, therefore, to erect troughs for eyeing them near the spawning-grounds.

During November one-third of the eggs obtained were shipped to Mr. R. D. Hume, in San Francisco, from which point they were transferred to his hatchery at Wedderburn, at the mouth of the Rogue River, where they were hatched and liberated in adjacent waters.

The balance of the eggs were hatched at the station, producing 1,850,000 fry, which were held until May 15 and fed on canned fish;

silver salmon and steelhead trout were used for this purpose, being canned in 2½ gallon tin cans, with caps of thin tin. The cans were stacked in a retort and were allowed to remain for 3 hours at a temperature of 254° F., when they were taken out and the vents closed, no salt being used in the process. Canned salmon has proved fairly satisfactory as fish food at this station, and it must be used here, owing to the impossibility of securing other material. Its cost, also, is very light, as it can be put up by men employed for other purposes. It was hoped that the cans might be used over and over for a number of years, but it was found impossible to prevent their collapse while cooling, which renders them valueless for subsequent use.

During the season 14,500 eggs were taken from two female salmon through slits cut in the abdomen, instead of spawning them in the usual manner. Milt was applied before washing the blood from the eggs, and they were then placed in baskets and separate records kept to note the result of the experiment. Only 16 per cent of them were lost during incubation, and the loss in fry prior to their liberation in Rogue River amounted to 221.

The smallest matured female salmon taken during the season, from which 1,800 eggs were secured, weighed before spawning 5¾ pounds, and after spawning 4½ pounds. The length of this fish was 24½ inches.

Efforts were made to collect silver salmon at Elk Creek, but the results were very disappointing, only 133,000 eggs being secured. These were hatched and the fry were liberated in Elk Creek.

The steelhead work commenced on March 1 and was continued until May 18, the total take of eggs aggregating 370,000, which were disposed of as follows: 25,000 were shipped to the Tuxedo Club, New York; 50,000 to Wisconsin; 80,000 to Wyoming; 46,000 to St. Johnsbury Station, Vt.; 45,000 to Duluth Station, Minn. The balance were hatched, and the 65,850 fry resulting were planted in Elk Creek.

LITTLE WHITE SALMON STATION, WASHINGTON (J. N. WISNER, SUPERINTENDENT).

Early in July the station was opened and preparations commenced for the conduct of salmon work in the fall. The hatching apparatus was put in thorough repair, the upper rack was constructed, four traps built, and later on four other racks were placed in position. A small boat, 24 feet long, 6½ feet beam, was provided for use in planting fish, and at the Big White Salmon, which was operated as an auxiliary for collecting and eying eggs, two large racks and a good downstream trap were put in. Racks were also constructed in Tanner and Eagle creeks.

By September 10 everything was in readiness and men had been sent to the Big White Salmon to commence operations. It was not deemed advisable to detail a crew to Tanner and Eagle creeks, as the work at both points was experimental, and it was thought a visit there every few days would be sufficient. This conclusion proved wrong, however, as a visit on September 18 showed that the fish had entered

and were spawning. The superintendent at once purchased supplies for both points and sent down a force of men, but on their arrival it was found that a sudden rise in both streams had carried away the racks. It is now believed that from two to three million eggs can be collected from these streams in future.

On the Little White Salmon the first eggs were received September 12. For the first five days the collections were comparatively small, but they increased daily until September 21, when 1,069,000 were taken. The total collections for the season on the Little White Salmon and the Big White Salmon aggregated 12,840,700 eggs.

The fall run of salmon was reported to be very fair, but the great majority of the fish were caught before they could enter the streams to spawn. According to the Oregon law fishing can be lawfully conducted up to and including August 15, and this condition of affairs operates unfavorably on the work of the station. Another matter for regret is that the Little White Salmon, which is acknowledged as probably the best spawning-ground of the salmon in the Columbia River region, is being ruined by deposits of sawdust. Every possible effort has been made by the superintendent to have this nuisance abated, but so far the results have not been satisfactory.

A few of the fish this season were taken by gill nets and seines, but the great majority were captured by means of downstream traps. These traps were necessarily put in where there was considerable fall of water, and consisted of pickets 20 feet long, placed 2 inches apart, forming a bed in the river. From either end of the upstream end wing dams or racks were built leading upstream and within a few feet of the banks of the river. The ends of the traps pointing upstream were submerged and weighted into position, and the downstream ends were held on horses, about 18 inches above the water. The space between the end of the racks and the shore was left to allow fish to pass upward. Some distance above each rack were deep holes, in which the fish would lie for a few days after ascending. As they ripened they dropped out on the riffles to spawn, and when a sufficient number to warrant it were on the riffles, a seine was passed across the river above them. This was then rapidly hauled downstream for the purpose of frightening the salmon. It is in the nature of a salmon to turn and swim downstream rapidly when startled, and in doing so they encountered the rack, which led them to the trap, where their great momentum carried them out of the water onto the beds, where pickets took the salmon and assorted them, placing males and females in separate pens and returning the green fish to the water.

The spawning operations were conducted as follows: A female was stunned by a blow on the head, after which it was put into a spawning-box and securely tied. The spawn-taker then placed the bottom of the box on the floor and lifted the head of the fish until it was at an angle of about 80°, with the back down. The spawning-pan was held immediately below and close to the vent by an assistant, while the

spawn-taker expressed the eggs. In the meantime a male salmon, which had been gotten in readiness by tying a line securely around its caudal peduncle, was manipulated by a second assistant, who grasped the line near the tail of the fish with the left hand, drawing its head between the knees with the right, thus holding it securely suspended with the belly down. The pan containing the eggs was held immediately below, and the milt expressed by the assistant with the right hand. Eggs and milt were carefully stirred until thoroughly mixed, when sufficient water to barely cover the eggs was added, and the mass again stirred to insure the milt coming in contact with every egg. They were then allowed to remain for 1½ minutes, after which they were washed and transferred to the hatchery in buckets, 15,000 being placed in each bucket.

For the first five days the eggs were picked; they were then covered and allowed to remain undisturbed until about 30 days old, when they were again washed thoroughly and picked at regular intervals until shortly before hatching, when they were distributed in the troughs, 5,000 to each apartment, after which they were tended as before.

The superintendent having been ordered to Washington, Mr. G. H. Tolbert assumed charge of the station on October 22, and the eggs on hand were hatched under his direction.

Of the eggs taken, 4,953,000 were transferred to Clackamas and other stations; 5,620,000 fry were hatched from the balance, and the distribution was commenced on December 7. It is believed that this work could be much more satisfactorily performed with a small steam launch, and it is recommended that one be procured.

As it had been decided to rear as many fry as possible, arrangements were made for a supply of fish food consisting principally of beef liver, ground and mixed with mill feed. Canned salmon was used as an experiment, but as it was not of good quality the results were not satisfactory. The young fish commenced taking food on December 30, and the last of them were planted April 28.

Baker Lake, Washington (H. H. Buck, Superintendent).

Arrangements for the capture of blueback salmon were made, as usual, during the summer by the construction of racks near the mouth of the river. It has been the practice to put in the racks just above the lake to prevent the fish from ascending the stream. For about 2 miles the river runs through an alluvial deposit of gravel and driftwood in several ever-changing channels, and with swift, strong current, often carrying immense trees torn from the banks higher up. The first year of the Commission's work racks were built in five places and by constant attention and repair were kept in place through the season. This year a location nearer the lake was selected, where the river could be closed by two racks, but the principal one was carried away by a sharp rise of water on August 25, and no attempt was made to rebuild it, as it was thought that all of the fish had passed up that

were likely to ascend the river. Furthermore, it was believed that bluebacks would not go above the lake in large numbers, and that the time for testing the matter was opportune; but experience proved that probably over 25 per cent did ascend the river, and after they leave the lake their capture is difficult and expensive.

The first ripe female was taken on September 7, and fishing continued without interruption until October 25, resulting in the capture of 1,140 females, which produced 4,171,000 eggs. No account was taken of the male fish. The eggs hatched without unusual losses, and 3,834,553 fry were liberated in Baker Lake and its tributaries.

At the close of the blueback season fishing for silver salmon was commenced in three creeks tributary to the river, about a mile above the lake, and in a slough or old branch at the head or east end of the lake. By means of traps, seines, and gill nets 78 ripe females were captured before the cold rains and the high stage of the water came. From these 222,000 eggs were collected, which yielded 172,041 fry.

Early in March it was decided to again attempt the collection of eggs of the steelhead trout, and a location on Phinney Creek, about 5 miles from Birdsview and some 30 miles from Baker Lake, was selected and the work of reopening an old road to the site was commenced. A camp outfit was installed in some old ranch buildings near by, and by the middle of the month a rack was completed and net fishing commenced under the direction of Mr. Henry O'Malley. Only a few fish were caught, and it soon became evident that the run of steelheads was over. Explorations on Phinney Creek, Grandy Creek, and the Skagit River did not show any large numbers, all testimony seeming to prove that the principal run had gone up in January.

In accordance with instructions from the office efforts were made to reduce the number of Dolly Varden trout in the lake, as it was believed they were feeding principally on the young salmon fry liberated there. A limited number were killed, but great quantities came up from the Skagit River, and it was soon found to be impossible to materially reduce them without making a systematic effort on the main river.

During the year improved connections have been made with mail and railroad by the construction of a trail down the east side of Baker River and the extension of the Hamilton branch of the Great Northern Railroad to Baker.

Details of distribution.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Shad:			
Connecticut Fish Commission, Stratford, Conn		3,210,000	
Hadlyme station, Conn		5,618,000	
Nanticoke River, Seaford, Del		1,860,000	
Brandywine Creek, Wilmington, Del		2,500,000	
Blackbird Creek, Middletown, Del		150,000	
Appoquirimink Creek, Middletown, Del		150,000	
Smyrna Creek, Smyrna, Del		150,000	
Leipsic Creek, Cheswold, Del		240,000	
St. John Creek, Dover, Del		980,000	
Murderkill Creek, Felton, Del		980,000	
Mispillion Creek, Milford, Del		860,000	
Indian River, Millsboro, Del		786,000	
Broadkiln Creek, Nassau, Del		480,000	
Potomac River, opposite Fish Lakes, D. C			2,000,000
St. Marys River, Glen St. Marys, Fla		450,000	
Suwannee River, Ellaville, Fla		451,000	
Aucilla River, Aucilla, Fla		250,000	
Ocklockonee River, Ocklockonee, Fla		450,000	
Little River, Quincy, Fla		450,000	
Chattahoochee River, River Junction, Fla		450,000	
Hillsboro River, near Tampa, Fla		325,000	
Ichetucknee River, near Branford, Fla		375,000	
Santa Fe River, near High Springs, Fla		375,000	
Blue Springs, near Julietta, Fla		175,000	
Peace River, near Bartow, Fla		175,000	
Miami River, Miami, Fla		375,000	
Anclote River, Tarpon Springs, Fla		125,000	
Suwanochee River, near Dupont, Ga		200,000	
Toms Creek, near Alexanderville, Ga		375,000	
Savannah River, near Augusta, Ga		1,125,000	
Tugeloo River, near Folsom, Ga		375,000	
Ocmulgee River, near Macon, Ga		500,000	
Potomac River, off Bryan Point, Md		1,448,000	
Pomonkey Creek, Md		1,810,000	
Accokeek Creek, Md		660,000	
Broad Creek, Md		881,000	
Hunting Creek, Md		481,000	
Piscataway Creek, Md		2,145,000	
Swan Creek, Md		585,000	
Point of Rocks, Md		450,000	
Chesapeake Bay, Battery Haul, Md		2,693,000	
Carpenter Point, Md		2,805,000	
Eastern Flats, Md		3,731,000	
Western Flats, Md		2,476,000	
Channel, Md		6,661,000	
Off Mill Creek, Md		1,208,000	
Western Channel, Md		1,333,000	
Eastern Channel, Md		1,000,000	
Locust Point, Md		563,000	
Susquehanna River, Garrett Island, Md		1,338,000	
Port Deposit, Md		1,275,000	
Frenchtown, Md		1,168,000	
Elk River, Elk River, Md		1,712,000	
Bush River, Bush River, Md		950,000	
Gunpowder River, Gunpowder River, Md		450,000	
Patuxent River, Laurel, Md		750,000	
Pocomoke River, Snowhill, Md		2,500,000	
Miles River, Easton, Md		2,753,000	
Patapsco River, Relay, Md		1,000,000	
Maryland Fish Commission, Salisbury, Md	1,000,000		
Druid Hill Park, Md	4,235,000		
Wankinco River, Wareham, Mass		397,050	
Shark River, Belmar, N. J		450,000	
Great Egg Harbor Bay, Mays Landing, N. J		450,000	
Salem Creek, Salem, N. J		680,000	
South River, Oldbridge, N. J		450,000	
Delaware River, Howells Cove, N. J	6,720,000	11,141,000	
Off Bennett's Fishery, N. J		1,000,000	
Lambertville, N. J		1,580,000	
Milford, N. J		9,054,000	
Hudson River, Catskill, N. Y		7,784,000	
Albany, N. Y		5,372,000	
Delaware River, Callicoon, N. Y		3,230,000	
F. G. Mitchell, New York, N. Y	42,000		
Edenton Bay, Edenton, N. C		6,826,000	
Chowan River, Edenton, N. C		4,394,000	
Avoca, N. C		11,169,000	
Colerain, N. C		2,005,000	
Perquimans River, Hertford, N. C		2,387,000	
Roanoke River, Plymouth, N. C		6,045,000	
Pasquotank River, Elizabeth City, N. C		2,900,000	
Tar River, Washington, N. C		3,000,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Shad—Continued.			
Trent River, Newbern, N. C		910,000	
Cape Fear River, Fayetteville, N. C		589,000	
Scuppernong River, Columbia, N. C		2,360,000	
Salmon Creek, Avoca, N. C		3,265,000	
Albemarle Sound, Edenton, N. C		5,430,000	
Susquehanna River, Fites Eddy, Pa		450,000	
Peachbottom, Pa		888,000	
Delaware River, Delaware Water Gap, Pa		450,000	
Rhode Island Fish Commission, Providence, R. I		2,249,950	
Pedee River, Pedee, S. C		751,000	
Black River, Kingstree, S. C		750,000	
Waccamaw River, Conway, S. C		500,000	
Sampit River, Georgetown, S. C		500,000	
Cooper River, Monks Corner, S. C		625,750	
Combahee River, Yemassee, S. C		625,750	
Ashepoo River, Ashepoo, S. C		625,750	
Edisto River, Jacksonboro, S. C		625,750	
Savannah River, Woodlawn, S. C		500,000	
Potomac River, off Dove Creek, Va		528,000	
Pohick Creek, Va		1,216,000	
Occoquan Bay, Va		3,758,000	
Hunting Creek, Va		1,137,000	
Nansemond River, Suffolk, Va		450,000	
Total	11,997,000	179,290,000	2,000,000
Quinnat salmon:			
McCloud River, Baird, Cal		889,570	
California Fish Commission, Sisson, Cal	3,402,036		
Clackamas River, Clackamas, Oreg		2,607,759	1,668
Spring Branch, Clackamas, Oreg		1,370,013	
Pond connected with Clackamas River, Clackamas, Oreg		450,000	
Bennett Creek, Clackamas, Oreg		192,000	
Hood River, Hood River, Oreg		380,000	
Columbia River, Hood River, Oreg		42,000	
Shell Rock, Oreg		225,000	
Mitchell Point, Oreg		721,000	
Nicolia, Oreg		21,000	
Ostergards, Oreg		21,000	
Linsley Creek, Oreg		23,680	
Rogue River, Rogue River Station, Oreg		350,000	
Trail, Oreg		1,500,058	
Herman Creek, Herman Creek, Oreg		127,000	
R. D. Hume, Wedderburn, Oreg	1,100,000		
Oregon Fish Commission, Portland, Oreg	1,628,000		
Big White Salmon River, White Salmon, Wash		691,000	
Little White Salmon Lake, Little White Salmon, Wash		1,653,000	
Dog Creek, Dog Creek, Wash		74,000	
Columbia River, Underwoods Landing, Wash		150,000	
White Salmon Landing, Wash		96,000	
Drano, Wash		75,000	
Thirteen Mile Point, Wash		583,000	
Walters, Wash		61,000	
Olsen Creek, Wash		40,000	
Gnat, Wash		40,000	
Sprague, Wash		148,000	
Rock Creek, Rock Creek, Wash		254,000	
L. Z. Leiter, Lake Geneva, Wis	25,000		
Government of New Zealand, Auckland, New Zealand	500,000		
Total	6,655,036	12,785,080	1,668
Atlantic salmon:			
Phillips Lake, Hancock County, Me			10,000
Pleasant River, Brownville, Me			37,700
Penobscot River, Grindstone, Me			63,410
Mattawamkeag River, Oakfield, Me			70,510
Moosetocmaguntic Lake, Bemis, Me			1,000
Phillips Lake, Bangor, Me		10,000	
Fishing Creek, Frederick, Md		4,516	
New Hampshire Fish Commission, Laconia, N. H	200,000		
New York Aquarium, Battery Park, New York, N. Y			100
Fish Pond, Bryn Mawr, Pa			64
Total	200,000	14,516	182,784
Landlocked salmon:			
Connecticut Fish Commission, Windsor Locks, Conn			2,000
Rock Creek, Zoological Park, D. C		4,500	
Spring Brook, Ellsworth Falls, Me			1,000
Rift Pond, Great Pond, Me			1,000
Canaan Lake, Camden, Me			1,000

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Landlocked salmon—Continued.			
Phillips Lake, Lakehouse, Me			1,000
Lake St. George, Thorndike, Me			2,000
Norcross Pond, Farmington, Me			1,000
King and Bartlett lakes, Farmington, Me			1,000
Clearwater Pond, Farmington, Me			2,000
North Pond, Farmington, Me			1,000
Big Island Lake, Farmington, Me			2,000
Varnum Pond, Farmington, Me			1,000
Little Jim Pond, Farmington, Me			1,000
Sweets Pond, Farmington, Me			1,000
Duck and Junior lakes, Winn, Me			1,000
Decker Ponds, Bingham, Me			1,000
Pierce Pond, Bingham, Me			3,500
Clear Pond, Bingham, Me			1,000
Rowe Pond, Bingham, Me			500
Rowe and Bean ponds, Bingham, Me			1,000
Jewett Pond, Bingham, Me			1,000
Otter Ponds, Bingham, Me			1,500
Jackson Pond, Oakland, Me			1,000
Ellis and McGrath ponds, Oakland, Me			1,000
Roach Pond, Greenfield, Me			1,000
Sysladobsis Lake, Grand Lake Stream, Me			8,000
First Debsconeag Lake, Great Works, Me			2,000
Moose Pond, Hartland, Me			1,000
Lake George, Skowhegan, Me			1,000
Parmacheene Lake, Oxford County, Me			1,500
Water Company's Reservoir, Belfast, Me			1,000
Swan Lake, Belfast, Me			1,000
Moosehead Lake, Greenville, Me			4,500
Holbrook Pond, Holden, Me			1,000
Long Pond, Great Pond, Me			2,500
Long Pond, Bar Harbor, Me			2,000
Tunk Pond, Tunk Pond, Me			1,500
Brewer Pond, Brewer Junction, Me			2,000
Donnell Pond, Franklin, Me			1,500
Lake Thompson, Oxford, Me			1,000
Pleasant River Lake, Cherryfield, Me			1,000
Embden Lake, Monmouth, Me			1,000
Crystal Lake, Waldoboro, Me			2,000
Lake Anasaguntieook, Canton, Me			2,000
Wilson Lake, Wilton, Me			1,000
Green Lake, Otis, Me		175,231	41,000
Branch Pond, Dedham, Me		60,000	30,133
Patten Pond, Ellsworth, Me		30,000	8,800
Big and Little Bear ponds, Canton, Me			1,000
Boyden Lake, Perry, Me			3,000
Indian Pond, Shirley, Me			5,000
Twin Lakes, Brunswick, Me			200
Grand Lake, Washington County, Me		29,332	9,303
Grand Lake Stream, Washington County, Me		47,360	16,559
Moosetocmaguntic Lake, Bemis, Me			3,014
Williams Pond, Bucksport, Me		3,000	
Maine Fish Commission, Enfield, Me	15,855		
Billings Pond, Ellsworth, Me		15,000	
John F. Stanley, East Auburn, Me	5,000		
Hampden Pond, Holyoke, Mass			1,000
Watuppa Lakes, Fall River, Mass			2,000
Lake Quinsigamond, Worcester, Mass			1,000
Furnace Pond, Hanover, Mass			1,000
Podunk Pond, Brookfield, Mass			1,000
Chauncey Lake, Westboro, Mass			1,000
Neck Pond, West Barnstable, Mass			1,000
Massachusetts Fish Commission, Northampton, Mass	10,000		
Wilkinsonville, Mass	5,000		
C. C. Wood, Plymouth, Mass	10,000		
William H. Drew, Plymouth, Mass	5,000		
Tehanto Club, Wenaumet, Mass	5,000		
Michigan Fish Commission, Paris, Mich	10,000		
Penacook Lake, Concord, N. H			2,000
Webster Lake, Franklin, N. H			2,000
Lake Tarleton, Pike Station, N. H			1,000
Dan Hole Pond, Center Ossipee, N. H			1,600
Lake Massabesic, Manchester, N. H			1,000
New Hampshire Fish Commission, Bristol, N. H	10,000		
Tuxedo Club, Tuxedo Park, N. Y	10,000		1,000
Lake George, Caldwell, N. Y			10,000
New York Aquarium, Battery Park, New York, N. Y			100
Adirondack League Club, Fulton Chain, N. Y	10,000		
Utah Fish Commission, Murray, Utah	5,000		
Caspian Lake, Greensboro, Vt			11,098
Willoughby Lake, Westmore, Vt			7,047
Big and Little Averill ponds, Averill, Vt			2,099

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Landlocked salmon—Continued.			
Lake Dunmore, Salisbury, Vt			1,738
Vermont Fish Commission, St. Johnsbury, Vt	10,000		
L. Doyen-Vitry, Brussels, Belgium	10,000		
G. Annville Serebelloui, Milan, Italy	10,000		
Total	130,855	364,423	236,691
Silver salmon:			
Elk Creek, Trail, Oregon		128,000	
Skagit River, Baker Lake, Wash		172,041	
Total		300,041	
Blueback salmon:			
Skagit River, Baker Lake, Wash		3,834,453	
Steelhead trout:			
Eagle River, Berry Station, Colo			20,000
Fryingpan River, Thomasville, Colo			14,000
South Platte River, Buffalo, Colo			13,800
Maize Lake, Hailey, Idaho			3,000
Lake Tesemini, Rathdrum, Idaho			10,000
Portneuf River, Pebble, Idaho			3,000
Morrison Lake, Ellsworth Falls, Me			2,000
Phillips Lake, Lakehouse, Me		5,000	5,000
Alamoosook Lake, East Orland, Me			5,172
Green Lake, Otis, Me			1,370
Catlin Reservoir, Dorsey, Mont			5,000
Picnic Springs, Monida, Mont			5,000
Bridger Creek, Gallatin County, Mont			10,000
Lake Champlain, Rouses Point, N. Y			3,498
New York Aquarium, Battery Park, N. Y			100
Tuxedo Lake, Tuxedo Park, N. Y			2,000
Tuxedo Club, Tuxedo Park, N. Y	25,000		
Clear Creek, Clackamas, Oreg			25,000
Elk Creek, Trail, Oreg		65,850	
Trout Pond, Bryn Mawr, Pa			68
Otter Creek, Vergennes, Vt			900
Newark Pond, Newark, Vt			2,100
Crystal Lake, Barton, Vt			2,100
Mississquoi River, Swanton, Vt			6,600
Lamoille River, Johnson, Vt			1,200
Sheldon, Vt			2,000
Cambridge Junction, Vt			2,000
A. J. McNab, Lake Nebagemain, Wis	50,000		
Wyoming Fish Commission, Laramie, Wyo	80,000		
Total	155,000	70,850	144,908
Loch Leven trout:			
Maquoketa River, Forestville, Iowa			3,000
Fishing Creek, Frederick, Md		9,342	
Long Lake, near Alpena, Mich		9,600	
Torch Lake, Antrim County, Mich		40,000	
Hopkins Lake, Spearfish, S. Dak		5,000	
Fish Pond, Spearfish, S. Dak		5,000	
Fish Pond, Piedmont, S. Dak		5,000	
Spring Ponds, Rapid City, S. Dak		10,000	
Fish Pond, Merritt, S. Dak		5,000	
A. J. McNab, Lake Nebagemain, Wis	10,000		
Wyoming Fish Commission, Sheridan, Wyo			10,000
Total	10,000	88,942	13,000
Rainbow trout:			
Chewacla Quarry Pond, Opelika, Ala			300
Applicants in Alabama			1,500
Sabina, Bear, and Wilderness creeks, Tucson, Ariz			1,000
Applicant at Prescott, Ariz			250
Fern Lake, Russellville, Ark			800
Chicot Lake, Lake Village, Ark			1,000
Lake Chatawa, Lawrence, Ark			300
Hurricane Creek, Bryant, Ark			500
Applicants in Arkansas			800
West Dallas Creek, Ridgway, Colo		2,000	
Willow Run, Jefferson, Colo		1,000	
Prospect Park Lakes, Cimarron, Colo		3,000	
Barnard Creek, Cripple Creek, Colo		3,000	
Sweetwater Lake, Gypsum, Colo		3,000	
Hourglass Lake, Loveland, Colo		5,000	
Soldiers' Home Pond, District of Columbia			12
Panther Creek, Turnerville, Ga			500

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Rainbow trout—Continued.			
Little Cedar Creek, Cavespring, Ga			400
Bear Creek, Lookout Mountain, Ga			500
Spring Lake, Tunnel Hill, Ga			500
Atherton Creek, Jasper, Ga			500
Applicant at Lovejoy, Ga			500
Notre Dame Lake, South Bend, Ind		5,000	
Spring Lake, Oakland City, Ind		5,000	
Spring Brook, Bristol, Ind		5,000	
Trout Pond, Bristol, Ind		5,000	
Applicant at Lebanon, Ind		2,000	
Spring Creek, Orchard, Iowa			2,000
Sny Magill Creek, North McGregor, Iowa			1,000
Spring Creek and Pond, Riceville, Iowa			1,000
Mill Creek, Bellevue, Iowa			1,175
Maquoketa River, Forestville, Iowa		50,000	
Turkey River, Cresco, Iowa		18,000	
Upper Iowa River, Limesprings, Iowa		18,000	
Willow Creek, Mason City, Iowa		18,000	
Spring Branch, Manchester, Iowa		5,000	
Volga River, Fayette, Iowa		15,000	
Applicant at Manchester, Iowa			60
Spring Pond, Ossawatomie, Kans			500
Lake Walking, Milldale, Ky			500
Crystal Lake, Ryland, Ky			750
Applicants in Kentucky			1,500
Spring Run, Hagerstown, Md			1,000
Whiteoak Run, Oakland, Md			1,000
Deer Branch, Butler, Md			350
Ridgely Branch, Butler, Md			400
Gray Rock Creek, Butler, Md			350
Barren Rock Creek, Rocky Ridge, Md			500
Tributary of Gunpowder River, Texas, Md			350
Spring Brook, Conowingo, Md			400
Branch of Western Run, Glyndon, Md			500
Pretty Boy Creek, Shamburg, Md			250
Price Creek, Philipolis, Md			150
Crabtree Creek, Swanton, Md			500
Pocomoke River, Snowhill, Md			500
Little Gunpowder River, Parkton, Md			200
Browning Dam, Oakland, Md			1,000
Paint Branch, Hyattsville, Md			1,000
Fishing Creek, Frederick, Md		7,816	
Applicants in Maryland			1,100
Maryland Fish Commission, Baltimore, Md	20,000		
Massachusetts Fish Commission, Wilkinsonville, Mass	25,000		
Hadley, Mass	25,000		
W. G. Davis, Boston, Mass	15,000		
L. B. Handy, South Wareham, Mass	20,000		
W. S. Nickerson, Kingston, Mass	5,000		
Bacon Pond, Hyannis, Mass			431
Branches of Rifle River, Westbranch, Mich		5,000	
Pine River, Lincoln, Mich		8,000	
Washington River, Washington Harbor, Mich		10,000	
Red Run, Dorr, Mich		6,000	
Little Long Lake, Harrison, Mich		5,000	
East Branch Ontonagon River, Watersmeet, Mich		5,000	
Coldwater Brook, Freeport, Mich		3,000	
Huron River, Milford, Mich		19,000	
Spring Brook trout hatchery, Kalamazoo, Mich	20,900		
Gill Lake, Duluth, Minn		10,000	
Poplar River, Lutsen, Minn		5,000	
Lester River, Duluth, Minn		4,900	
Sac Creek, Bois d'Arc, Mo			1,500
Spring Brook, Aurora, Mo			300
Spring Lake, Carthage, Mo			1,500
Blue Spring, Bourbon, Mo			12,700
Wittenberg Spring, Steelville, Mo			8,400
Cedar Gap Pond, Cedargap, Mo			8,733
Mountain Grove Pond, Mountain Grove, Mo			3,333
Railroad Reservoir, Willow Springs, Mo			8,734
Bennett Spring Branch, Lebanon, Mo			16,250
Sweetwater Creek, Christopher, Mo			1,500
Indian Creek, Christopher, Mo			1,500
Applicants in Missouri			2,900
Applicant at Leigh, Nebr			2,000
New Hampshire Fish Commission, Plymouth, N. H	25,000		
Lilear Lake, Blairstown, N. J			500
A. M. Bigelow, Branchville, N. J	25,000		
Pecos River, Glorietta, N. Mex			1,000
Mescalero Lake, Tularosa, N. Mex			1,000
Rio Penasco and Julian lakes, Tularosa, N. Mex			750
Mariano Lake, Gallup, N. Mex			1,000

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Rainbow trout—Continued.			
Rio Ruidosa, Capitan, N. Mex			3,750
Rita Leandra Creek, Maxwell City, N. Mex			1,000
Rock Creek, Maxwell City, N. Mex			1,000
Rita del Ore Creek, Maxwell City, N. Mex			1,000
Rita Bernal Creek, Maxwell City, N. Mex			500
Vermejo Creek, Maxwell City, N. Mex			1,000
Castle Rock Creek, Maxwell City, N. Mex			500
Gonzales Creek, Maxwell City, N. Mex			500
Pena Flor Creek, Maxwell City, N. Mex			500
Bonita and Eagle creeks, Alamogordo, N. Mex			1,375
Irrigation Canal, Espanola, N. Mex			300
Applicants in New Mexico			700
Montague Stevens, Magdalena, N. Mex	44,960		
Trout Lake, Fayetteville, N. C			600
West Fork Pigeon River, Canton, N. C			600
Deep Creek, Bryson City, N. C			500
Swannanoa River, Swannanoa, N. C			500
Linville River, Linville, N. C			1,000
Mill Pond, Flatrock, N. C			500
Nantahala River, Jarretts, N. C			500
Cranberry Creek, Cranberry, N. C			500
Elk River, Elkpark, N. C			3,000
Punching Fork Creek, Madison County, N. C		5,000	
Applicants in North Carolina			950
R. E. Carson, Sapphire, N. C.	40,000		
W. C. Fisher, Brevard, N. C.	10,000		
C. A. Schenck, Biltmore, N. C	25,000		
Applicants in Oklahoma			2,000
Bear and McKay creeks, Pendleton, Oreg		5,000	
McElhattan Creek, McElhattan, Pa			500
Mountain Stream, McElhattan, Pa			500
Falling Spring Creek, Chambersburg, Pa			500
Bear Run, Bear Run, Pa			2,000
Rattling Run, Tremont, Pa			500
Laurel Run, Center Hall, Pa			500
Spring Branch, Elverson, Pa			500
Millbach Creek, Sheridan, Pa			500
South Mountain Creek, Sheridan, Pa			500
Spring Brook, Sheridan, Pa			500
Beaverdam Run, Hooversville, Pa			500
Tumbling Run, Hunters Run, Pa			300
Tag Run, Hunters Run, Pa			300
Pine Grove Lake, Hunters Run, Pa			300
Mountain Creek, Hunters Run, Pa			300
Laurel Dam, Hunters Run, Pa			500
Beamer Creek, Hunters Run, Pa			300
Fellows Creek, Columbia Crossroads, Pa			500
Speck Lake, Elizabethville, Pa			500
Letort Spring, Carlisle, Pa			900
Spotts Dam, Carlisle, Pa			300
Bonny Brook, Carlisle, Pa			300
Radley Run, Pocopson, Pa			500
Lower Briar Creek, Berwick, Pa			500
Wolfinger Run, Berwick, Pa			500
Loyal Sock Creek, Laporte, Pa			1,000
Spring Lake, Glenside, Pa			500
Haynes Branch, Shinglehouse, Pa			800
East Branch Fishing Creek, Bloomsburg, Pa			300
Trout and Big runs, Bloomsburg, Pa			600
Spring Brook, Newton Square, Pa			500
Trout Run, York, Pa			500
Louck Run, York, Pa			500
Schall Run, York, Pa			500
Spring Garden Run, York, Pa			500
Cooper Creek, New Freedom, Pa			500
Webber Branch, New Freedom, Pa			500
Piney Creek, Altoona, Pa			300
Little Kettle Creek, Carters Camp, Pa			900
Lick Run, Millhall, Pa			500
Old Log Cabin Creek, Honesdale, Pa			500
Big Brook, Honesdale, Pa			500
Middle Fork Creek, Glenhazel, Pa			500
Boyer Brook, Smethport, Pa			300
Daly Brook, Smethport, Pa			300
Barney Brook, Smethport, Pa			300
Blacksmith Brook, Smethport, Pa			300
Walcott Creek, Smethport, Pa			300
Brewer Run, Clermont, Pa			300
West Branch Potato Creek, Clermont, Pa			300
Red Mill Brook, Clermont, Pa			300
Robins Brook, Clermont, Pa			300
Wernway Brook, Clermont, Pa			300

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Rainbow trout—Continued.			
Palmerville Creek, Clermont, Pa			300
Card Machine Run, Johnstown, Pa			500
Alevins Run, Johnstown, Pa			350
Mill Run, Johnstown, Pa			1,300
Bens Creek, Johnstown, Pa			1,350
Mountain Brook, West Hickory, Pa			500
Miller Creek, Hamburg, Pa			500
Peg Hunters Run, Nanticoke, Pa			300
South Pond Creek, Nanticoke, Pa			600
Badlock Creek, Nanticoke, Pa			600
Roaring Brook, Nanticoke, Pa			600
Harvey Creek, Nanticoke, Pa			900
Fade Creek, Nanticoke, Pa			300
Cease Creek, Nanticoke, Pa			300
David Spring Creek, Nanticoke, Pa			500
Pike Creek, Nanticoke, Pa			300
Roberts Run, Central, Pa			500
Tatman Run, Huntingdon, Pa			300
Stony Creek, Huntingdon, Pa			300
Rattlesnake Run, Wetham, Pa			500
Goose Pond Creek, Cresco, Pa			500
Bear and Sand Runs, Landrus, Pa			2,100
Bear and Bob Creek, Landrus, Pa			900
Bear Run and Rock Creek, Landrus, Pa			300
Sand Run and Rock Creek, Landrus, Pa			300
Rock Creek, Landrus, Pa			300
Beech Creek, Snowshoe, Pa			2,000
Rock Run, Snowshoe, Pa			250
South Fork of Beech Creek, Snowshoe, Pa			250
Egypt Creek, Susquehanna, Pa			300
Brushville Creek, Susquehanna, Pa			300
Mill Creek and branches, Ligonier, Pa			600
Spring Creek, Bellefonte, Pa			1,000
East Lake Creek, Susquehanna, Pa			300
Dunker Creek, Susquehanna, Pa			300
Fishing Creek, Millhall, Pa			1,000
Little Creek, Obold, Pa			500
Oak Creek, Reading, Pa			1,000
Pike Creek, Plymouth, Pa			900
North Branch of Buffalo Creek, Mifflinburg, Pa			600
Limestone Run, Mifflinburg, Pa			300
Molls Hollow Run, Mifflinburg, Pa			300
Weirick Gap Run, Mifflinburg, Pa			300
Raritan Run, Mifflinburg, Pa			300
Panther Run, Mifflinburg, Pa			300
Ridgeview Pond, Derry, Pa			300
South Mountain Trout Run, Richland, Pa			300
Cedar Run, Lockhaven, Pa			300
Hawk Run, Cherrytree, Pa			500
Spring Meadow Dam, Bedford, Pa			500
Wapwallopen Creek, Wapwallopen, Pa			500
Trout Pond, Bryn Mawr, Pa			77
Applicant in Pennsylvania			2,700
Julius E. Brooks, Allegheny, Pa	25,000		
Pine and Smith Fork Creeks, McMinnville, Tenn			500
Flint River, Fayetteville, Tenn			1,000
McFarland Lake, Chattanooga, Tenn			500
East Lake, Chattanooga, Tenn			500
Clark Spring, Chattanooga, Tenn			500
Crosby Creek, Delrio, Tenn			500
Lake Burem, Rogersville, Tenn			500
Fall Creek, Russellville, Tenn			500
Duck River, Lewisburg, Tenn			500
Spring Lake, Meadowbrook, Tenn			500
Camp Creek, Greenville, Tenn			1,000
Little River, Rockford, Tenn			500
Big Stony Creek, Elizabethton, Tenn			500
Fish Pond, Cleveland, Tenn			5,000
Little Doe Creek, Doe, Tenn			500
Clinch River and Sycamore Creek, Lone Mountain, Tenn			500
Whiteoak Creek, McEwen, Tenn			250
Fish Pond, Johnson City, Tenn		1,000	
Rock Creek, Rockcreek, Tenn			6,000
Unaka Branch, Rockcreek, Tenn			4,000
Martin Creek, Erwin, Tenn		3,000	4,000
Love Branch, Erwin, Tenn			6,000
Nolachucky River, Unaka, Tenn			6,000
Dry Creek, Unicoi, Tenn			4,000
Dick Creek, Unicoi, Tenn		4,000	
North Indian Creek, Unicoi, Tenn			6,000
Doe River, Roan Mountain, Tenn			6,000
South Indian Creek, Chestoa, Tenn			5,600
Applicants in Tennessee			2,725

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Rainbow trout—Continued.			
Gageby Creek, Mobeetie, Tex			200
Lake Hayes, Marshall, Tex			125
City Reservoir and Tyler Lake, Fort Worth, Tex			900
Utah Fish Commission, Murray, Utah	44,000		
Beaver Pond, Proctor, Vt			2,998
Colvin Run, Vienna, Va			500
Mill Creek, Blacksburg, Va			1,000
Elk Creek, Crockett, Va			1,000
Private Pond, Crockett, Va			500
Stuffles Run and Pond, Crockett, Va			600
Fish Pond, Ellerson, Va			500
Fish Pond, Granite, Va			500
Middle River, Staunton, Va			1,000
South Fork Holston River, Marion, Va			7,100
Fish Pond, Marion, Va			500
Staley Creek, Marion, Va			1,000
North Fork Holston River, Saltville, Va			2,600
Robinson Pond, Saltville, Va			400
Fish Pond, Howardsville, Va			500
Spring Brook, Delaplane, Va			500
Elk Creek and Pond, Natural Bridge, Va			500
Abraham Creek, Winchester, Va			500
Redbud Creek, Winchester, Va			500
Spring Brook, Winchester, Va			500
Big Crab Orchard Creek, Crab Orchard, Va			500
Laurel Creek, Bland, Va			1,500
Little River, Plains, Va			975
Fish Pond, Amelia, Va			500
Private pond, Fred, Va			500
Mountain stream, Craigsville, Va			500
Spring Brook, Boyce, Va			500
Spring Pond, Dublin, Va			1,000
Big Walker Creek, Dublin, Va			5,000
Page Spring, Boyce, Va			1,000
Reed Creek, near Wytheville, Va			3,000
Tate Run, Wytheville, Va			1,930
Peak Creek, Pulaski, Va			2,400
Little Walker Creek, Pulaski, Va			5,000
Little River and Laurel Creek, Pulaski, Va			3,000
Max Creek, Pulaski, Va			2,000
Cripple Creek, Beverly Furnace, Va			2,500
Tinker Creek, Roanoke, Va			2,600
Glade Creek, Roanoke, Va			2,400
Mason Creek, Roanoke, Va			2,400
Upper Lick Run, Roanoke, Va			1,600
Roanoke River, Roanoke, Va			5,000
Wolfe Creek, Abingdon, Va			2,400
Fish Pond, Etter, Va			800
North and South Forks, Clinch River, Burkes Garden, Va			7,000
Clear Fork Creek, Burkes Garden, Va			2,000
Meadow Creek, Emory, Va		3,000	
Applicants in Virginia			2,850
Rattlesnake Run, Shepherdstown, W. Va			500
Keyer Run, Rowlesburg, W. Va			500
Meadow Brook, Romney, W. Va			500
Rockwell Run, Orleans Roads, W. Va			500
Spring Brook, Martinsburg, W. Va			500
Fish Pond, Charles Town, W. Va			500
Buckhannon River, Hall, W. Va			3,500
J. B. Johnson, Morgantown, W. Va	1,000		
Bear Lake, Minocqua, Wis			2,000
Beef River, Augusta, Wis			1,000
Bridge Creek, Augusta, Wis			1,000
Horse Creek, Augusta, Wis			400
Middle Inlet to Lake Nogueboy, Athelstane, Wis			1,994
Reefer Creek, Orienta, Wis		5,000	
Walter Bailey, Malvern Wells, England	25,000		
Moreton Frewen, Innishannon, Ireland	20,000		
Total	415,860	277,716	343,727
Black-spotted trout:			
Lone Pine Lakes, Fort Collins, Colo			20,000
Trout Lake, Fort Collins, Colo			10,000
Surface Creek, Cedar Edge, Colo			20,000
Lakes and streams, Cascade, Colo			20,000
Eagle River, Berrys Ranch, Colo			55,000
Sweetwater Lake, Gypsum, Colo			25,000
Gypsum Creek, Gypsum, Colo			15,000
Willow Creek, Leadville, Colo			17,000
Rock Creek, Leadville, Colo			15,000
Arkansas River, Leadville, Colo			15,000

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Black-spotted trout—Continued.			
Halfmoon Creek, near Leadville, Colo.			18,000
Fryingpan Creek, between Norrie and Basalt, Colo.			120,000
Ivanhoe Lake, Ivanhoe, Colo.			10,000
Trout Lake, Soda Springs, Colo.			5,000
Crystal River, Carbondale, Colo.			20,000
South Platte River, Hartsell and Idlewild, Colo.			30,000
North Fork of South Platte River, between Buffalo and Grant, Colo.			150,000
Public Lake, Idaho Springs, Colo.			15,000
St. Vrain River and tributaries, Lyons, Colo.			150,000
West Fork of North St. Vrain River, Lyons, Colo.			10,000
Middle Fork of St. Vrain River, Lyons, Colo.			30,000
Cabin Creek, Lyons, Colo.			10,000
Fox Creek, Lyons, Colo.			10,000
Rock Creek, Lyons, Colo.			10,000
Goose Creek, Wagonwheel Gap, Colo.			25,000
Los Pinos Creek, Osier, Colo.			25,000
Snow Mass Lake, Aspen, Colo.			25,000
Gunnison River, Elk Creek, Colo.			50,000
Cimarron River, Cimarron, Colo.			20,000
South Boulder Creek, Central City, Colo.			50,000
Poncho and Marshall creeks, between Salida and Montrose, Colo.			5,000
Dallas Creek, Dolores and Mancos rivers, between Ridgway and Durango, Colo.			75,000
Lime Creek, Thomasville, Colo.			35,000
Brush Creek, Eagle, Colo.			15,000
Grizzly Creek, Glenwood Springs, Colo.			10,000
Spring Lake, Aspen, Colo.			10,000
Mesa Creek Lakes, Cotopaxi, Colo.			25,000
Maize Lake, Hailey, Idaho.			13,000
Cottonwood Spring, Blackfoot, Idaho.			5,000
Trout Lake, Granite, Idaho.			2,000
Portneuf River, Pebble, Idaho.			10,000
Henrys Lake, Henrys Lake, Idaho.		105,000	
Applicant at Henrys Lake, Idaho.		5,000	
George W. Rea, Rea, Idaho.	20,000		
R. A. Osborne, Rea, Idaho.	25,000		
Charles J. Trude, Rea, Idaho.	25,000		
Thomas Turton, Kilgore, Idaho.	50,000		
Sorren Nelson, Kilgore, Idaho.	10,000		
Yellowstone River, Livingston, Mont.			25,000
Bear Creek, Whitlash, Mont.			15,000
Big Spring Creek, Lewiston, Mont.			10,000
Waterdog Lake, Sweetgrass, Mont.			5,000
Trout Pond, Poplar, Mont.			5,000
Sixteen-Mile Creek, Lombard, Mont.			20,000
Little Blackfoot River, Elliston, Mont.			10,000
Spring Pond, Harlow, Mont.			5,000
Trout Lake, Fridley, Mont.			10,000
Cottonwood lake and stream, Martinsdale, Mont.			25,000
Little Casino Creek, Lewiston, Mont.			5,000
Walter Creek, Pony, Mont.			5,000
Smith River, Great Falls, Mont.			5,000
Sun River, Great Falls, Mont.			5,000
Hound Creek, Great Falls, Mont.			5,000
Sheep Creek, Great Falls, Mont.			5,000
Nez Perces Creek, Woodville, Mont.			5,000
Dearborn Creek, Craig, Mont.			12,500
Prickly Pear Creek, Helena, Mont.			12,500
Lake Five, Belton, Mont.			10,000
Vincent Lake, Anaconda, Mont.			10,000
Cottonwood Creek, Bozeman, Mont.			10,000
Fish Pond, Bozeman, Mont.			5,000
Middle Creek, Bozeman, Mont.			10,000
Lyman Creek, Bozeman, Mont.			30,000
East Gallatin River, Bozeman, Mont.			15,000
Trout Lake, Bozeman, Mont.			10,000
Bridger Creek, Gallatin County, Mont.			60,000
Stone Creek, Gallatin County, Mont.			15,000
Bear Creek, Gallatin County, Mont.			15,000
Fish Pond, Whitehall, Mont.			10,000
Johnson Lake, Twin Bridges, Mont.			10,000
Blacktail Creek, Dillon, Mont.			10,000
Roberts Creek, Oka, Mont.			5,000
Lake Palmer, Butte, Mont.			5,000
Lake Wilder, Bernice, Mont.			5,000
Roosevelt Lake, Silverbow, Mont.			5,000
Spring Creek, Drummond, Mont.			5,000
Crater Lake, Dillon, Mont.			5,000
Private Lake, Salesville, Mont.			20,000
Tributaries of Missoula River, Bonner, Mont.			4,800

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Black-spotted trout—Continued.			
Duck Creek, Lakeview, Mont		5,000	
Spearfish Creek, Elmore, S. Dak			2,000
Fish pond, Spearfish, S. Dak			71
Utah Fish Commission, Murray, Utah	20,000		
Bigelow Creek, Spokane, Wash			5,000
Little Spokane River, Spokane, Wash			5,000
Spring Creek, Spokane, Wash			10,000
Knester Lake, Milan, Wash			10,000
Pend de Oreille River, Newport, Wash			38,500
Fish pond, Wilbur, Wash			1,000
Wyoming Fish Commission, Laramie, Wyo	75,000		
Total	225,000	115,000	1,736,371
Brook trout:			
North Fork Cache la Poudre River, Tie Siding, Colo			5,000
Squaw Lake, Canyon City, Colo			1,000
Pond and stream, Cotopaxi, Colo			10,000
Trout Lake, Twinlakes, Colo			5,000
Beaver Lakes, Dillon, Colo			5,000
North Fork of St. Vrain River, Lyons, Colo			20,000
South Fork of St. Vrain River, Lyons, Colo		20,000	
St. Vrain River, Lyons, Colo		45,000,	12,000
Freeman Creek, Estabrook, Colo			1,000
Van Place Lake, Cimarron, Colo		5,000	
Big Cimarron River, Cimarron, Colo		10,000	
Little Cimarron River, Cimarron, Colo		25,000	
Crystal River, Carbondale, Colo			5,000
Jarvis Creek and ponds, Montrose, Colo		10,000	
Pelton Lake, Montrose, Colo		10,000	
Spring Creek, Montrose, Colo		10,000	
North Fork of South Platte River, Cassells, Colo		15,000	8,000
Bailey, Colo		15,000	11,000
Grant, Colo			3,000
Cliff, Colo		10,000	3,000
Chaseville, Colo		10,000	3,000
Slaghts, Colo			17,000
Shawnee, Colo		15,000	
Buffalo, Colo		15,000	17,000
Pinegrove, Colo		5,000	6,000
Brookside, Colo			6,000
Domerock, Colo		5,000	8,000
Between Grant and Cliff, Colo		40,000	
Tributaries of North Fork of South Platte River, Meadows, Colo			8,000
North Fork of South Platte River and Geneva Creek, Grant, Colo		15,000	
South Platte River, Muldoon, Colo		5,000	
Deer Creek, Bailey, Colo			8,000
Elk Creek, Pinegrove, Colo		40,000	5,000
Kenosha Creek, Webster, Colo		5,000	3,000
Beaver Creek, Webster, Colo			3,000
Jefferson Creek, Jefferson, Colo			5,000
Spring Lake, Jefferson, Colo		10,000	
North Fork of Geneva Creek, Cassells, Colo			3,000
Beeler Creek, Chaseville, Colo			5,000
Brandy Creek, Chaseville, Colo			3,000
Lake Hassell, Idaho Springs, Colo		5,000	5,000
Clear Creek, Idaho Springs, Colo			10,000
Chicago Creek, Idaho Springs, Colo		5,000	
St. Mary Lake, Idaho Springs, Colo		5,000	
Loch Lomond, Idaho Springs, Colo		5,000	
Rock Creek, Cycle Park, Colo			10,000
Chinn Lake and Mill Creek, Dumont, Colo			5,000
Naylor Lake, Georgetown, Colo		10,000	10,000
Grand Lake, Georgetown, Colo			10,000
Clear Creek, Georgetown, Colo			5,000
Buffalo Creek, Buffalo, Colo		5,000	3,000
Wigwam Creek, Buffalo, Colo		10,000	
Bear Creek, Morrison, Colo			3,000
Blue Creek and tributaries, Basalt, Colo		10,000	
Cold Springs Pond, Basalt, Colo		5,000	
Beaver Creek Pond, Gunnison, Colo			5,000
Tributaries of Beaver Creek, Gunnison, Colo		5,000	
Elk Creek, Cliff, Colo		10,000	
Fish Lake, Durango, Colo			5,000
Boulder, Mammoth, and Jenny Lind creeks and Mammoth Lake, Blackhawk, Colo			30,000
Lake Lenore, Ouray, Colo		5,000	
Middle Evergreen Lake, Leadville, Colo			18,000
Reservoir, Victor, Colo		10,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Woods Lake, Thomasville, Colo		10,000	
Gardner Lake, Fort Collins, Colo		20,000	
South Arkansas River, Salida, Colo		10,000	
Spring Pond, Denver, Colo		15,000	
Trout Pond, Loveland, Colo		10,000	
Buckhorn Creek, Loveland, Colo		10,000	
Fremont Lake, Climax, Colo		5,000	
Blue River, Breckenridge, Colo		10,000	
Price Creek, Shawnee, Colo		10,000	
Tributaries of East River, Crested Butte, Colo		10,000	
Goose Creek, Wagonwheel Gap, Colo		15,000	
Fryingpan River, Sellar, Colo		30,000	
Aspetuck River, Reading, Conn		4,995	
Saugatuck River, Reading, Conn		5,000	
Norwalk River, South Wilton, Conn		9,990	
Brambletye Brook, Chester, Conn		4,995	
Trout Brook and Pond, Manchester, Conn		9,995	
Applicants in Connecticut		6,000	
E. G. Shortlidge, Wilmington, Del			500
Cottonwood Spring, Genesee, Idaho			500
Fish Pond, Genesee, Idaho			500
Halverson Pond, Moscow, Idaho			500
Maize Lake, Hailey, Idaho			1,000
Sweetwater Creek, Lewiston, Idaho			2,500
Bull Run and Patrick Creek, Kendrick, Idaho			1,500
Potlatch Creek, Kendrick, Idaho			1,500
Portneuf River, Pebble, Idaho			2,500
Fish Pond, Mindoka, Idaho			500
Swank Creek, North Manchester, Ind		10,000	
Pinhook Pond, South Bend, Ind		5,000	
Spring Pond, Crawfordsville, Ind		5,000	
Baldwin and Bigalk brooks, Cresco, Iowa			2,000
Steel Branch, Edgewood, Iowa			1,000
Spring Creek, Osage, Iowa			1,000
Bloody Run, North McGregor, Iowa			1,000
Mill Creek, Bellevue, Iowa		20,000	
Spring Branch, Manchester, Iowa		17,500	
Maquoketa River, Manchester, Iowa			5,000
McIntyre Springs, McIntyre, Iowa		10,000	
Kane Creek, Decorah, Iowa		49,900	
Spring Brook, Decorah, Iowa		20,000	
Village Creek, Lansing, Iowa		30,000	
Bacon Creek, Lansing, Iowa		12,000	
Clear Creek, Lansing, Iowa		8,000	
Pennamaquan Lake, Eastport, Me		5,000	
Brewer Pond, Brewer, Me		5,000	
Harrington River, Cherryfield, Me		10,000	
Sandy Brook, Unity, Me		15,000	
Herd Pond, Norcross, Me		10,000	
Second Herd Pond, Norcross, Me		5,000	
First Debsconeag Lake, Norcross, Me		5,000	
Blunt Pond, Ellsworth, Me		5,000	
Patton Pond, Ellsworth, Me		30,000	
Moosehead Lake, Greenville, Me		25,000	
Upper Wilson Pond, Greenville, Me		5,000	
Spring Lake, Phillips, Me		5,000	
Little Jim Fond, Phillips, Me		5,000	
Sandy River, Phillips, Me		10,000	
Long Pond, Phillips, Me		5,000	
Pushaw Lake, Bradley, Me		5,000	
Clearwater Pond, Farmington, Me		5,000	
Clearwater and Varnum Ponds, Farmington, Me		5,000	
Lake Anasagunticook, Canton, Me		5,000	
Big and Little Bear Ponds, Canton, Me		5,000	
St. George Lake, Thorndike, Me		5,000	
Sabbath Day Lake, Danville, Me		5,000	
Otter Ponds, Bingham, Me		15,000	
Bean Pond, Bingham, Me		5,000	
Brandy Pond, Bingham, Me		5,000	
Clear Pond, Bingham, Me		5,000	
Jewett Pond, Bingham, Me		5,000	
Rowe Pond, Bingham, Me		5,000	
Great Pond, Oakland, Me		5,000	
Messalouskee Pond, Oakland, Me		5,000	
Ellis and McGrath Ponds, Oakland, Me		5,000	
Hebron Pond, Monson, Me		10,000	
Held Pond, Jackman, Me		10,000	
Canaan Lake, Rockland, Me		5,000	
Turkey Pond, Rockland, Me		5,000	
Phillips Lake, Dedham, Me		5,000	
Branch Pond, Dedham, Me		30,000	
Sprague Meadow Brook, Calais, Me		5,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Russell Pond, Houlton, Me		5,000	
Sebago Lake, Sebago, Me		20,000	
Great Pond, Belgrade, Me		5,000	
Little Sebago Lake, Gray, Me		5,000	
Jordan Pond, Eden, Me		5,000	
Williams Pond, Orrington, Me		8,000	
Swan Lake, Belfast, Me		5,000	
Private Pond, Franklin, Me		5,000	
Donnell Pond, Franklin, Me		5,000	
Alton Pond, Alton, Me		5,000	
Green Lake, Otis, Me		64,529	59
Grand Lake Stream, Washington County, Me			176
Browning Dam, Oakland, Md			10,300
Fishing Creek, Frederick, Md		308	
Applicants in Maryland			1,383
Lebine Brook, Dunstable, Mass			3,000
Fletcher Brook, Dunstable, Mass		10,000	
Bash Bish Brook, Mount Washington, Mass			994
Silver Spring, Newburyport, Mass			500
Spring Pond, Newburyport, Mass			1,000
Lake Chaubunagungamaug, Webster, Mass		15,000	
Headwaters of Westfield River, Williamsburg, Mass		10,000	
North Branch, Springfield, Mass		9,995	
Trout Brook, Everett, Mass		10,000	
Trout Brook, Fall River, Mass		9,990	
Tatunck Brook, Worcester, Mass		9,995	
Massachusetts Fish Commission, Worcester, Mass	25,000		
Hadley, Mass	25,000		
Centennial Mill Creek, Dailey, Mich		10,000	
Shaw Creek, Dailey, Mich		10,000	
Harriman Creek, Schoolcraft, Mich		10,000	
Wells Creek, Schoolcraft, Mich		10,000	
Trout Pond, Farmington, Mich		5,000	
Buckhorn Creek, Holly, Mich		10,000	
Head Thread River, Holly, Mich		10,000	
Hill Creek, Sidnaw, Mich		10,000	
Paint Creek, Ypsilanti, Mich		20,000	
Boardman River, Traverse City, Mich		10,000	
Boardman River, Mayfield, Mich		25,000	
Tributaries of Boardman River, South Boardman, Mich		25,000	
Kalkaska, Mich		25,000	
Brush Creek, Hillman, Mich		10,000	
Townline Creek, Harrison, Mich		20,000	
Asylum Creek, Kalamazoo, Mich		10,000	
Spring Brook, Kalamazoo, Mich		10,000	
Black River, Tower, Mich		20,000	
Miller Creek, Onaway, Mich		20,000	
Wolf Creek, Alpena, Mich		20,000	
Thurston Brook, Oxford, Mich		10,000	
Spring Brook, Oxford, Mich		35,000	
Tributary of Flint River, Oxford, Mich		25,000	
Parret Brook, Oxford, Mich		5,000	
Trout streams in Iosco County, near East Tawas, Mich		100,000	
Tributaries of Maple River, Pelleston, Mich		25,000	
Au Sable River, Grayling, Mich		100,000	
Tobacco River and branches, Clare, Mich		30,000	
Coldwater Creek and Chippewa River, Farwell, Mich		20,000	
Comstock Creek and Chippewa River, Evart, Mich		20,000	
Little Manistee and Au Sable rivers, Baldwin, Mich		40,000	
Little Manistee River, Canfield, Mich		50,000	
Cannon Creek, Rapid City, Mich		50,000	
Spencer Creek, Alden, Mich		30,000	
Cedar Creek, Bellaire, Mich		35,000	
Sycamore Creek, Lansing, Mich		5,000	
Pine River, Lincoln, Mich		10,000	
Bradley and Brooks creeks, Mankato, Minn			3,000
Cross River, Gunflint, Minn		10,000	
Flute Reed River, Hovland, Minn		10,000	
Cook Valley Creek, Kellogg, Minn		5,000	
Gill Lake, Duluth, Minn		5,000	
Spring Brook, Northfield, Minn		50,000	
A. Lauth, Fanning, Mo	10,000		
Cherry Creek, Madison County, Mont			5,000
Short Creek, Fivemile, Mont			5,000
Sixteen Mile Creek, Lombard, Mont			5,000
Trout Lake, Fridley, Mont			600
Spring Creek, Whitehall, Mont			2,500
Lebo Creek, Bigelk, Mont			5,000
Trout Pond, Lewiston, Mont			3,000
Penacook Lake, Concord, N. H			3,000
Bear, Dolfe, and Tannery brooks, Concord, N. H		15,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Lake Tarleton, Pike Station, N. H			2,000
Sucker Lake, Franklin, N. H			2,000
Leighton Brook, Harrisville, N. H			1,990
Fish Pond, Rockingham Junction, N. H			1,000
Chase Brook, Hudson, N. H			3,000
Brickyard Brook, Hudson, N. H			4,500
Spring Lake, Percy, N. H			10,000
Trout Brooks, Hampstead, N. H			5,000
Fish Pond, Wentworth, N. H			1,000
Trout Brook, Hollis, N. H			1,000
Gilford and Farrar brooks, New Hampshire			2,000
Milford Brooks, Milford, N. H			2,000
Cæsar Brook, Milford, N. H			9,800
Fish Pond, Lisbon, N. H		5,000	
Sunapee Lake, Newbury, N. H			4,665
Trout Brook, Nashua, N. H			300
Chase and Brickyard brooks, Nashua, N. H		10,000	
Trout Brook, Brookland, N. H			600
Wildmeadow Brooks, Grafton, N. H		4,995	
Trout Brooks, Exeter, N. H		10,000	
Christine Lake, Groveton, N. H		15,000	
Brooks in Cheshire County, Keene, N. H		10,000	
Meadow Brook and other streams, Warner, N. H		10,000	
Indian River and Hains Brook, Canaan, N. H		10,000	
Emerson Brook, Westrindge, N. H		5,000	
Hutchinson Brook, Wilton, N. H		9,700	
Streams in Hillsboro County, Brookline, N. H		10,000	
Trout Brook, Peterboro, N. H		5,000	
New Hampshire Fish Commission, Colebrook, N. H			8,071
Laconia, N. H	25,000		
A. M. Bigelow, Bevans, N. J	20,000		
Canisteo River, Hornellsville, N. Y		10,000	
Fish Pond, Amityville, Long Island, N. Y		5,000	
Croton River, Patterson, N. Y		10,000	
Ragged Lake, Owls Head, N. Y		14,500	
Twitchell Creek, Beaver River, N. Y		12,000	
Carpenter Brook, Halfway, N. Y		10,000	
Silver Lake, Big Moose, N. Y		11,000	
Fish Pond, Moira, N. Y		2,200	
Tributaries of Oriskany Creek, Waterville, N. Y		10,000	
Long Pond, Pleasant Lake, N. Y		10,000	
Mud Pond, Pleasant Lake, N. Y		10,000	
Lily Pond, Pleasant Lake, N. Y		25,000	
Montfredy Brook, Syracuse, N. Y		30,000	
Handsome Brook, Sherburne, N. Y		10,000	
Rum Brook, Hartsdale, N. Y		5,000	
Hiepfel Lake, Brinckerhoff, N. Y		5,000	
Wiscoy Creek, Bliss, N. Y		10,000	
Wynantskill Creek, Troy, N. Y		10,000	
Loon Lake, Beaver River, N. Y		12,000	
Owego Creek, Owego, N. Y		10,000	
Lake Massawepei, Childwold, N. Y		14,500	
Trout streams near Watertown, N. Y		20,000	
Trout Lake, Babylon, N. Y		18,000	
New York Aquarium, Battery Park, N. Y			100
East Fork Pigeon River, Canton, N. C			100
Mad River, Bellefontaine, Ohio		20,000	
Spring Brook, Massillon, Ohio		20,000	
Spring Lake, Bellefontaine, Ohio		20,000	
Little Miami River, Springfield, Ohio		20,000	
Spring Branches, Troy, Ohio		5,000	
Trout Pond, West Liberty, Ohio		5,000	
Neal Creek, Hood River, Oreg			7,000
Tributaries of Willamette River, Salem, Oreg			3,500
Cox Creek, Albany, Oreg		10,000	
McElhattan Creek, McElhattan, Pa			400
Sandspring Run, Ashland, Pa			150
Beaverdam Run, Hooversville, Pa			300
Rattlesnake Run, Wetham, Pa			300
Beach Haven Creek, Plymouth, Pa			150
Pike Creek, Plymouth, Pa			150
Shickshinny Creek, Berwick, Pa			100
Lockard Dam, Berwick, Pa			100
Bowman Run, Berwick, Pa			100
Piney Creek, Altoona, Pa			100
Clover Creek, Altoona, Pa			100
Rapid Run, Lewisburg, Pa			150
Little Kettle Creek, Carters Camp, Pa			300
Lick Run, Millhall, Pa			100
Potter Creek, Martinsburg, Pa			100

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Clover Creek, Martinsburg, Pa			100
Spring Creek, Bellefonte, Pa			200
Logan Branch, Bellefonte, Pa			100
Spring Run, McElhattan, Pa			100
Harveys Lake, Nanticoke, Pa			150
Sandy Run, Fort Washington, Pa			150
Buckhill Creek, Cresco, Pa			150
Mill Creek, Ligonier, Pa			150
Beech Creek, Snowshoe, Pa			100
Rock Run, Snowshoe, Pa			100
Conrad Creek, Bernville, Pa			100
Tub Mill Creek, New Florence, Pa			150
Freeman Creek, Hamburg, Pa			100
Bernhardt Reservoir, Reading, Pa			100
Little Cacorsing Creek, Wernersville, Pa			300
Trout Pond, Bryn Mawr, Pa			70
Julius E. Brooks, Allegheny, Pa	20,000		
Applicants in Pennsylvania			350
Tarkiln Brook, Woonsocket, R. I		10,000	
Piggery Brook, Woonsocket, R. I		10,000	
South Fork of Little Rapid Creek, Rochford, S. Dak			10,000
Spearfish Creek, Spearfish, S. Dak		5,000	20,000
Maurice, S. Dak			10,000
West Fork of Spearfish Creek, Elmore, S. Dak			10,000
East Fork of Spearfish Creek, Elmore, S. Dak			10,000
Grant Lake, Spearfish, S. Dak			5,000
Jelbert Lake, Spearfish, S. Dak		5,000	
Crow Creek, Spearfish, S. Dak		10,000	
Branch of Jim Creek, Piedmont, S. Dak			10,000
Little Elk Creek, Piedmont, S. Dak			10,000
Box Elder Creek, Nasby, S. Dak			15,000
Englewood, S. Dak			10,000
Piedmont, S. Dak		10,000	
Nemo, S. Dak		10,000	
Squaw Creek, Custer, S. Dak			10,000
Spring Lake, Hill City, S. Dak			5,000
Spring Creek, Hill City, S. Dak		10,000	
Horse Creek, Hill City, S. Dak		5,000	
Bruce Creek, Rapid City, S. Dak			5,000
Deer Lake, Rapid City, S. Dak		5,000	
Canyon Lake, Rapid City, S. Dak		10,000	
Lonetree Lake, Rapid City, S. Dak		10,000	
Sportsmen Lake, Rapid City, S. Dak		5,000	
Rapid Creek, Rapid City, S. Dak		10,000	
Fish Ponds, Rapid City, S. Dak		5,000	
Whitewood Valley Lake, Whitewood, S. Dak			2,000
Fish Pond, Deadwood, S. Dak			5,000
Rapid Creek, Mystic, S. Dak			1,000
Trout Lake, Mystic, S. Dak		5,000	
American Creek, Chamberlain, S. Dak		10,000	
Fall River, Hot Springs, S. Dak		10,000	
Bogus Jim Creek, Blackhawk, S. Dak		5,000	
Splitrock Creek, Corson, S. Dak		10,000	
Artificial Lake, Sturgis, S. Dak		10,000	
Silver Creek, Sturgis, S. Dak		10,000	
Lower Falsebottom Creek, St. Onge, S. Dak		10,000	
Pearl Creek, Huron, S. Dak		10,000	
Ezekiel Creek, Wilmot, S. Dak		5,000	
Spring Brook, Wilmot, S. Dak		5,000	
Applicants in South Dakoka			2,000
Upper Doe River and tributaries, Roan Mountain, Tenn		10,000	
Utah Fish Commission, Murray, Utah	25,000		
Mount Sterling Brook, Johnson, Vt		10,000	
Long Pond, Westmore, Vt			1,200
Schoolhouse Brook, Lunenburg, Vt			400
Caspian Lake, Greensboro, Vt		20,000	6,996
Little Leach Pond, Averill, Vt		4,990	2,200
Lyford Pond, Walden, Vt			1,050
Lake Mansfield, Stowe, Vt			6,000
Fish Pond, West Hartford, Vt			500
Spring Brooks, Mendon, Vt			1,998
Tributary to East Creek, Mendon, Vt		6,000	
North Comfret Brook, North Comfret, Vt			1,000
House of Correction Pond, Rutland, Vt			500
Shrewsbury Pond, Cuttingsville, Vt			1,000
Lake Ansel, Bethel, Vt			1,000
Martin Brook, Rochester, Vt			1,000
Shrewsbury Pond, Shrewsbury, Vt			600
Vermont Fish Commission, Roxbury, Vt			2,500
Standing Pond, Sharon, Vt		10,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Frog Pond and tributaries, Waterford, Vt		10,000	
Hilltop Pond, Waterford, Vt		2,500	
Duck Pond, Waterford, Vt		5,000	
Tributary of Connecticut River, Waterford, Vt		5,000	
Ayers Brook and tributaries, Randolph, Vt		5,000	
Hatch Pond and Brook, Randolph, Vt		10,000	
Trout Brook, Plymouth, Vt		10,000	
Caledonia Club Trout Pond, St. Johnsbury, Vt		10,000	
Tributaries of Passumpsic River, St. Johnsbury, Vt		5,000	
Hatchery Brook, St. Johnsbury, Vt		10,000	
Gos Hollow Brook and tributaries, near St. Johnsbury, Vt		12,500	
Lake Mansfield, Waterbury, Vt		10,000	
Wells River Fish and Game Club Pond, Wells River, Vt		30,000	
Water Andrick Brook, Barnet, Vt		5,000	
Lake Mitchell, West Norwich, Vt		70,000	
Fish Lake, McIndoe, Vt		10,000	
Warden, Lake Factory and Laramore brooks, East Barnet, Vt		10,000	
Darling Pond, Groton, Vt		15,000	
Small Pond, Brandon, Vt		4,000	
Jewell Brook, Ludlow, Vt		4,000	
Washburn Brook, Maidstone, Vt		6,000	
Sandborn Pond, West Burke, Vt		2,500	
Tributaries to Center Pond, West Burke, Vt		8,000	
Fish Pond, East Concord, Vt		10,000	
Trout Brook, North Danville, Vt		5,000	
Trout Brook, Sutton, Vt		5,000	
Line Brook, Kirby, Vt		2,500	
Mill Creek, Blacksburg, Va			300
Worman River, Charlottesville, Va			300
Alum Springs Run, Goshen, Va			99
Redbud Creek, Winchester, Va			200
Laurel Creek, Bland, Va			500
Thornton River, Luray, Va			200
Thompson Creek, Millboro, Va			6,500
Tate Run, Wytheville, Va			68
Fern Lake, Seattle, Wash			1,600
Mill Pond, Seattle, Wash			1,600
Bigelow Creek, Spokane, Wash			2,500
Little Spokane River, Spokane, Wash			2,500
Fish Lake, Ellensburg, Wash			2,500
Touchet Pond, Dayton, Wash			1,600
Connowai Creek, Wilbur, Wash			2,500
Fish Pond, Marshall, Wash			1,500
Fish Pond, Winlock, Wash			1,600
Mountain and Cascade lakes, Newhall, Wash			7,000
D. Marcot, Spokane, Wash	25,000		
Stream and Pond, Rowlesburg, W. Va			250
Houstin Run, Centralia, W. Va			500
F. A. Degler, Cheatbridge, W. Va	25,000		
Nordman Creek, Hortonia, Wis			1,469
Pine and other creeks, Hixton, Wis			1,468
Bear Grass and Thompson creeks, Augusta, Wis			1,000
Muskrat Creek, Augusta, Wis			1,000
Horse Creek, Augusta, Wis			600
Otter Creek, Augusta, Wis			1,000
Reefer Creek, Orienta, Wis		6,855	
Fish Pond, Beulah, Wyo			5,000
Beaver Lake, Weston County, Wyo			10,000
Beaver Creek, Eothen, Wyo		10,000	
South Fork of Redwater Creek, Beulah, Wyo			10,000
Fish Lake, Beulah, Wyo		5,000	
Sand Creek, Crook County, Wyo		10,000	
Redwater Creek, Farrall, Wyo		10,000	
Willow and Glen creeks, Yellowstone Park, Wyo		10,000	
Wyoming Fish Commission, Wolf, Wyo	51,000		
Sheridan, Wyo	100,000		
H. G. Parlett, Tokyo, Japan	10,000		
Total	361,000	3,394,732	678,206
Lake trout:			
Public Lake, Idaho Springs, Colo			9,850
Trout Lake, Sellar, Colo			4,000
Lyle Lake, Ivanhoe, Colo			4,000
Lake Ivanhoe, Ivanhoe, Colo			3,400
Rock Creek, near Zoological Park, D. C		13,600	
St. Marys Lake, South Bend, Ind		20,000	
First Debsconeag Lake, Norcross, Me		10,000	
Second Debsconeag Lake, Norcross, Me		10,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Lake trout—Continued.			
Morrison Pond, Dedham, Me		9,827	
Phillips Lake, Dedham, Me		150,000	
Green Lake, Dedham, Me		50,000	
Tunk Pond, Franklin, Me		100,000	
Maine Fish Commission, Enfield, Me	358,500		
Harris Pond, Lawrence, Mass		5,000	
Lake Huron, Alpena, Mich		500,000	45,000
8 miles off Alpena, Mich		125,000	
Off Sugar Island, Mich		500,000	
Off Thunder Bay Island, Mich		500,000	
Off mouth of St. Mary River, Mich		350,000	
Pine Lake, Charlevoix, Mich		240,000	
Lake Michigan, Petoskey, Mich			60,000
Mackinaw, Mich			40,000
Charlevoix, Mich		2,000,000	
Lake Superior, Long Point, Mich		280,000	
Todd, Harbor, Mich		280,000	
Fish Island, Mich		140,000	
Tobins Harbor, Mich		140,000	
Rock Harbor, Mich		140,000	
Washington Harbor, Mich		140,000	
Off Eagle Harbor, Mich		275,000	
Off mouth of Firesteel River, Mich		280,000	
Ontonagon, Mich		560,000	
Off Keystone, Mich		420,000	
St. Marys River, Sault Ste. Marie, Mich		350,000	
Straits of Mackinac, Mackinaw, Mich		1,000,000	
Clark, Loon, and Crooked lakes, Watersmeet, Mich		75,000	
Walnut Lake, North Farmington, Mich			7,996
Lake Fumee, Iron Mountain, Mich		25,000	
Round Lake, Hanover, Mich		25,000	
Michigan Fish Commission, Sault Ste. Marie, Mich	1,500,000		
Paris, Mich	500,000		
Lake Superior, Chicago Bay, Minn		280,000	
Grand Marais, Minn		560,000	
Poplar River, Minn		280,000	
Beaver Bay, Minn		280,000	
Duluth, Minn		135,000	
Leech Lake, Walker, Minn		75,000	
Jewett Lake, Fergus Falls, Minn		25,000	
Spofford Lake, Westmoreland, N. H		15,000	
New Hampshire Fish Commission, Laconia, N. H	400,000		
Crystal Lake, Albany, N. Y		20,000	
Pleasant Lake, Pleasant Lake, N. Y		35,000	
Longfellow Lake, Pleasant Lake, N. Y		25,000	
Lake Massawepei, Childwold, N. Y		20,000	
Snyder Lake, Troy, N. Y		20,000	
St. Lawrence River, Cape Vincent, N. Y		44,000	
Lake Ontario, off Grenadier Island, N. Y		824,550	
Dutchess Point, N. Y		481,450	
Adirondack League Club, Fulton Chain, N. Y	300,000		
New York Fish Commission, Caledonia, N. Y	2,500,000		
Utah Fish Commission, Murray, Utah	300,000		
Willoughby Lake, Westmore, Vt		11,400	
Stone Pond, Glover, Vt		10,000	
Caspian Lake, Greensboro, Vt		30,000	
Lake Dunmore, Salisbury, Vt		40,000	
Big Averill Pond, Averill, Vt		9,000	
Tributaries of Center Pond, West Burke, Vt		6,000	
Vermont Fish Commission, Roxbury, Vt	300,000		
Steilacoom Lakes, Lakeview, Wash		53,366	
American Lake, Lakeview, Wash		49,875	
Gravelly Lake, Lakeview, Wash		49,900	
Lake Superior, Bayfield, Wis		560,000	
Port Wing, Wis		280,000	
Wyoming Fish Commission, Wolf, Wyo	100,000		
Lake Superior, Rossput, Ontario, Canada		360,000	
Total	6,258,500	13,292,968	174,246
Scotch sea trout:			
Fishing Creek, Frederick, Md		11,191	
Tehanto Club, Wenaumet, Mass	10,000		
Lake George, Caldwell, N. Y			4,907
Total	10,000	11,191	4,907
Grayling:			
Lake Tesemini, Rathdrum, Idaho			3,500
Spring Brook, Manchester, Iowa			3,000

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Grayling—Continued.			
Michigan Fish Commission, Paris, Mich	200,000		
Petoskey, Mich			6
Elk Creek, Madison County, Mont		1,362,300	
Diamond Brook, Colebrook, N. H			519
Tributaries of Willamette River, Salem, Oreg			3,500
Bear and McKay creeks, Pendleton, Oreg		10,000	
North Fork of Meacham Creek, Pendleton, Oreg		36,000	
Catharine Creek, Union, Oreg		45,161	
Utah Fish Commission, Murray, Utah	70,000		
Caspian Lake, Greensboro, Vt			900
Beaver Pond, Proctor, Vt			296
Total	270,000	1,453,461	11,721
White-fish:			
R. E. Follett, Chicago, Ill	640,000		
Lake Michigan, Michigan City, Ind		4,000,000	
Charlevoix, Mich		19,000,000	
Mackinaw City, Mich		6,000,000	
Lake Erie, Stony Point, Mich		3,000,000	
Lake Huron, off Starve Island, Mich		4,000,000	
Thunder Bay Island, Mich		4,000,000	
Sturgeon Point, Mich		4,000,000	
North Point, near Alpena, Mich		11,000,000	
Presque Isle, Mich		4,000,000	
Scarecrow Island, Mich		3,000,000	
Near Detour, Mich		3,000,000	
Lake Erie, off Monroe Pier, Mich		10,000,000	
West Sister Island, Mich		9,500,000	
Lake Superior, Fishermans Home, Mich		2,400,000	
Isle Royale, Mich		3,000,000	
Ontonagon, Mich		4,400,000	
Near Whitefish Point, Mich		10,000,000	
Near Tequanemon Island, Mich		4,000,000	
Lake St. Clair, Lake St. Clair, Mich		13,000,000	
Long Lake, near Alpena, Mich		50,000	
St. Marys River, near Sault Ste. Marie, Mich		1,000,000	
Upper Detroit River, Detroit, Mich		35,000,000	
New Hampshire Fish Commission, Laconia, N. H	500,000		
St. Lawrence River, near Cape Vincent, N. Y		2,600,000	
Lake Ontario, off Grenadier Island, N. Y		10,952,000	
New York Fish Commission, Caledonia, N. Y	25,000,000		
Lake Erie, Starve Island Reef, off Put-in Bay, Ohio		3,000,000	
Niagara Reef, Put-in Bay, Ohio		2,000,000	
West Sister Island Reef, Put-in Bay, Ohio		3,000,000	
Green Island Reef, Put-in Bay, Ohio		2,000,000	
North Bass Island Reef, Put-in Bay, Ohio		37,500,000	
Middle Bass Island Reef, Put-in Bay, Ohio		3,000,000	
Michaels Reef, Put-in Bay, Ohio		6,000,000	
South Shore Reef, Put-in Bay, Ohio		6,000,000	
Rattlesnake Island Reef, Put-in Bay, Ohio		6,000,000	
Long Point Reef, off Kelly Island, Ohio		6,000,000	
Gull Island Reef, off Kelly Island, Ohio		10,000,000	
Port Clinton, Ohio		8,100,000	
off Kelly Island, Ohio		8,000,000	
Maumee Bay, off Toledo, Ohio		2,000,000	
Pennsylvania Fish Commission, Erie, Pa	10,554,000		
Harvey Lake, Harvey Lake, Pa		314,000	
American Lake, Lakeview, Wash		500,000	
Gravelly Lake, Lakeview, Wash		291,295	
J. B. Johnson, Morgantown, W. Va	5,000		
Lake Superior, off Iron River, Wis		2,400,000	
Raspberry Bay, Wis		2,400,000	
Wisconsin Fish Commission, Madison, Wis	10,000,000		
Total	46,699,000	279,407,295	
Pike perch:			
Sharon Pond, Sharon, Conn		500,000	
Cherokee Fishing Lake, East St. Louis, Ill		500,000	
White River, Bedford, Ind		1,000,000	
Mitchell, Ind		1,000,000	
Big Blue River, Corydon Junction, Ind		1,000,000	
Milltown, Ind		1,000,000	
Ohio River, Madison, Ind		1,000,000	
Brock and Fishing creeks, Salem, Ind		1,000,000	
Lake Calumet, Jasper, Ind		1,000,000	
Bass Lake, Basslake, Ind		1,000,000	
Lake Caldwell, Claypool, Ind		500,000	
Tippecanoe River, Winamac, Ind		500,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Pike perch—Continued.			
Chain Lake, South Bend, Ind		500,000	
Upper Iowa River, Chester, Iowa		1,000,000	
Lake Reba, Richmond, Ky		500,000	
Lake Ellerslie, Lexington, Ky		1,000,000	
Fern Lake, Middlesboro, Ky		500,000	
Potomac River, Sycamore Island, Md		1,750,000	
Dorothy and Singletary ponds, Millbury, Mass		1,250,000	
Massachusetts Fish Commission, Wilkinsonville, Mass	2,000,000		
Hadley, Mass	2,000,000		
Big Lake, Gaylord, Mich		1,000,000	
Kalamazoo River, Allegan, Mich		1,000,000	
Peach, Edwards, and Craps lakes, Westbranch, Mich		1,000,000	
Huron River, Ypsilanti, Mich		1,000,000	
Clark, Crooked, and Loon lakes, Watersmeet, Mich		900,000	
Island Lake, Brighton, Mich		1,000,000	
Lake Erie, off Bay Point, Monroe, Mich		25,000,000	
Michigan Fish Commission, Detroit, Mich	32,100,000		
Wild Rice River, Twin Valley, Minn		1,000,000	
Moose Lake, Hancock, Minn		1,000,000	
Bear Lake, Akely, Minn		500,000	
Shetek Lake, Currie, Minn		1,000,000	
Lake Washington, Mankato, Minn		1,000,000	
Duck Lake, Mankato, Minn		800,000	
Missouri Fish Commission, St. Joseph, Mo	10,000,000		
Morris Lake, Newton, N. J		1,000,000	
Mirror Lake, Browns Mills, N. J		500,000	
Susquehanna and Chenango rivers, Binghamton, N. Y		1,000,000	
Dewey Lake, Rockville Center, N. Y		1,250,000	
Lake Ozonia, St. Regis Falls, N. Y		1,000,000	
Cuba Lake, Cuba, N. Y		1,000,000	
St. Lawrence River, off Cape Vincent, N. Y		12,800,000	
Scioto and Sandusky rivers, Marion, Ohio		1,000,000	
Lake Erie, North Bass Island Reef, off Put-in Bay, Ohio		35,000,000	
Middle Bass Island Reef, off Put-in Bay, Ohio		10,000,000	
Green Island Reef, off Put-in Bay, Ohio		10,000,000	
Off Bells Point, Port Clinton, Ohio		20,000,000	
Ballast Island Reef, off Put-in Bay, Ohio		10,000,000	
Peach Point, off Put-in Bay, Ohio		587,200	
Youghiogheny River, Ohiopyle, Pa		500,000	
Clarion River, Kane, Pa		500,000	
Susquehanna River, Selinsgrove, Pa		1,000,000	
Harveys Lake, Alderson, Pa		500,000	
Allegheny River, Irvineton, Pa		500,000	
Oil City, Pa		1,000,000	
Lycoming Creek, Ralston, Pa		1,000,000	
Rockwell Lake, Clarendon, Pa		500,000	
Moosic Lake, Moosic Lake, Pa		1,000,000	
Lake Poponoming, Bethlehem, Pa		500,000	
Sailor Lake, Bethlehem, Pa		500,000	
Forest Lake, Montrose, Pa		500,000	
Elk Lake, Montrose, Pa		500,000	
Heart Lake, Montrose, Pa		500,000	
Tripp Lake, Montrose, Pa		500,000	
Eley Lake, Montrose, Pa		500,000	
Little River, Marysville, Tenn		1,000,000	
Tennessee River, Knoxville, Tenn		1,500,000	
Ocase and Hiawassee rivers, Cleveland, Tenn		1,000,000	
Emory River, Lancing, Tenn		1,000,000	
Tellico River, Athens, Tenn		1,000,000	
Crooked Fork Creek, Petros, Tenn		1,000,000	
Big Creek, Rogersville, Tenn		1,000,000	
Vermont Fish Commission, St. Johnsbury, Vt		16,750,000	
Lemonweir River, Mauston, Wis		1,000,000	
Pewaukee Lake, Waukesha, Wis		700,000	
Black River, Greenwood, Wis		1,000,000	
Total	46,100,000	194,787,200	
Lake herring:			
Lake Erie, off Put-in Bay, Ohio		8,000,000	
Lutes Point, Ohio		3,000,000	
North Bass Island Reef, off Put-in Bay, Ohio		4,000,000	
Gull Island Reef, off Kelly Island, Ohio		5,200,000	
Pennsylvania Fish Commission, Erie, Pa	30,820,000		
Total	30,820,000	20,200,000	
Sturgeon:			
Missisquoi River, Swanton, Vt		20,000	

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Pickerel:	
Devils Lake, Devils Lake, N. Dak.	300
Cat-fish:	
Pistakee Lake, Nippersink, Ill.	100
Spiritwood Lake, Jamestown, N. Dak.	1,300
Lake Hiawatha, Sykeston, N. Dak.	100
Stump Lake, Lakota, N. Dak.	437
Devils Lake, Devils Lake, N. Dak.	437
Total	2,374
Yellow perch:	
Clements Lake, Danville, Ill.	100
Pistakee Lake, McHenry, Ill.	25
Lake Hiawatha, Sykeston, N. Dak.	50
Stump Lake, Lakota, N. Dak.	223
Devils Lake, Devils Lake, N. Dak.	223
Total	621
Black bass:	
Millpond, Dothan, Ala.	10
Millpond, Gordon, Ala.	25
Millpond, Sprucepine, Ala.	100
Clear Creek, Nauvoo, Ala.	150
Ingram Millpond, Opelika, Ala.	200
Spring Pond, Gadsden, A a.	150
Kelly Lake, Jeff, Ala.	200
Whetstone Lake, Montgomery, Ala.	35
Rogers Lake, Letohatchee, Ala.	25
Millpond, Jamestown, Ala.	200
Spring Branch, Troy, Ala.	20
McCarty Millpond, Gerald, Ala.	50
Applicants in Alabama	1,185
Reservoir, Fairbanks, Ariz.	50
Ash Creek, Hillside, Ariz.	100
Kirkland Creek, Kirkland, Ariz.	50
Applicants in Arizona	200
Bull Bayou, Hot Springs, Ark.	50
Millpond, Pinebluff, Ark.	58
Lake Chicot, Lake Village, Ark.	50
Old River Lake, Colton, Ark.	50
Applicants in Arkansas	407
Twin Lakes, Canaan, Conn.	400
Twin Pond, New Haven, Conn.	100
Bantam Lake, Lake Station, Conn.	100
Lake Waremaug, New Milford, Conn.	200
Lake Waremaug, New Preston, Conn.	200
Spring Pond, Center Village, Conn.	250
Beecher Pond, Seymour, Conn.	100
Matchshop Pond, Seymour, Conn.	100
Copeland Reservoir, Seymour, Conn.	100
Emery Ice Pond, Seymour, Conn.	100
Sawmill Pond, Seymour, Conn.	100
Little River, Seymour, Conn.	100
Highland Lake, Winsted, Conn.	200
Applicants in Connecticut	100
Connecticut Fish Commission, Windsor Locks, Conn.	500
Spring Pond, Houston, Del.	100
E. G. Shortlidge, Wilmington, Del.	500
Potomac River, Chain Bridge, District of Columbia	200
Applicants in District of Columbia	82
Lake Flora, Hernando, Fla.	350
Lake Windmere, Espanola, Fla.	200
Lake Wenonah, Plymouth, Fla.	150
Blue Lake, Eustis, Fla.	400
Lake Juano, Eustis, Fla.	200
Lake Saunders, Eustis, Fla.	200
Altoona Lake, Altoona, Fla.	200
Lake Umatilla, Umatilla, Fla.	200
Trout Lake, Thomasville, Ga.	150
Dennis Creek, N da, Ga.	100
Lookout Creek, Dade County, Ga.	20
Daughtry Lake, McRae, Ga.	100

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
School Creek Millpond, Griffin, Ga.	150
Spalding Millpond, Griffin, Ga.	100
Yarbrough Millpond, Williamson, Ga.	100
Moffett Pond, Greenville, Ga.	75
Spring Pond, Mount Airy, Ga.	50
Bowden Millpond, Raleigh, Ga.	100
Jones Pond, Leesburg, Ga.	150
Walnut Pond, Nicholson, Ga.	100
Big Sandy Run, Gordon, Ga.	150
McDonald Pond, Cuthbert, Ga.	250
Ocmulgee River, Juliett, Ga.	300
Savannah River, Woodlawn, Ga.	250
Millpond, Lulaville, Ga.	150
King Millpond, Boxspring, Ga.	200
Applicants in Georgia	3,225
Fox River, Olney, Ill.	300
Druce Lake, Grayslake, Ill.	300
Grays Lake, Grayslake, Ill.	30
Pistakee Lake, McHenry, Ill.	129
Channel Lake, Antioch, Ill.	300
Spring Lake, Oakland, Ill.	15
Long Lake, Long Lake, Ill.	30
Clement Lake, Danville, Ill.	440
Wabash Pond, Taylorsville, Ill.	100
Pistakee Bay, Nippersink, Ill.	300
Applicants in Illinois	1,335
Spring Lake, Indianapolis, Ind.	150
Denzel Lake, New Haven, Ind.	100
Calumet Lake, Jasper, Ind.	500
White River, Muncie, Ind.	250
Bethany Park Lake, Brooklyn, Ind.	150
Guthrie Creek, Bedford, Ind.	200
Carr Lake, Claypool, Ind.	200
Yellow Creek Lake, Claypool, Ind.	200
Bass Lake, Bass Lake, Ind.	200
Spring Lake, Argus, Ind.	100
Stone Quarry Pond, Bloomington, Ind.	50
Manlove Park Lake, Milton, Ind.	150
Oakhurst Lake, Evansville, Ind.	100
St. Joseph and St. Mary Lakes, Evansville, Ind.	200
Lake James, Angola, Ind.	250
Lower Bayou, Howell, Ind.	250
Long Pond, Princeton, Ind.	300
Pine Lake, La Porte, Ind.	200
Pigeon Creek, Boonville, Ind.	250
Spring Lake, Plymouth, Ind.	150
Lake of the Woods, Plymouth, Ind.	150
Koontz Lake, Walkerton, Ind.	100
Crystal Lake, Anderson, Ind.	150
Loon Lake, Columbia City, Ind.	200
Wabash River, Williamsport, Ind.	250
Stone Quarry Pond, Batesville, Ind.	150
Bruce Lake, Winamac, Ind.	200
Catfish Lake, Westville, Ind.	100
Applicants in Indiana	2,750
Lake Elmwood, Fort Gibson, Ind. T.	66
Silver Lake, Adair, Ind. T.	67
Twinoak Tank, Marietta, Ind. T.	100
Cow Creek, Comanche, Ind. T.	150
Applicants in Indian Territory	167
Maquoketa River, Manchester, Iowa.	74
North Fork Maquoketa River, Worthington, Iowa.	20
Upper Iowa River, Chester, Iowa	10
Big Cedar River, Orchard, Iowa.	10
Volga River, Fayette, Iowa	10
Turkey River, Mabau, Iowa.	10
Crane Creek, Chester, Iowa	10
Cedar River, Charles City, Iowa.	10
Applicants in Iowa	390
Elm Run, Oswego, Kans.	30
McDowell Creek, Manhattan, Kans.	200
Cedar Creek, Manhattan, Kans.	100

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Wildcat Creek, Manhattan, Kans.	300
Deep Creek, Manhattan, Kans.	400
Big Blue River, Manhattan, Kans.	200
Eureka Lake, Manhattan, Kans.	100
Reservoir, Garden City, Kans.	60
Rock Creek, Brenner, Kans.	200
Lake View, Lakeview, Kans.	200
Railroad Lake, Abilene, Kans.	200
Pawnee Creek, Larned, Kans.	500
Reservoir, Larned, Kans.	160
Waldock Lake, Pratt, Kans.	100
Lake Jeannette, Leavenworth, Kans.	100
Reservoir, Colby, Kans.	100
Lake Rollings, Chenute, Kans.	30
Smoky Hill River, Enterprise, Kans.	300
Smoky Hill River, Salina, Kans.	200
Five Mile Lake, Dodge City, Kans.	45
Mulberry Creek, Ford, Kans.	30
Broke and Grasshopper creeks, Sabetha, Kans.	150
Spring Lake, Wichita, Kans.	30
Ash Creek, Hill City, Kans.	100
Wea and Bull creeks, Paoli, Kans.	200
Cottonwood River, Emporia, Kans.	200
Strawberry Lake, Fort Scott, Kans.	30
Circle Lake, Yates Center, Kans.	30
Spring Creek, Gove, Kans.	300
Reservoir, St. Francis, Kans.	100
Forest Lake, Bonner Springs, Kans.	150
Spring Lake, Raymond, Kans.	100
Spring Creek, Meade, Kans.	25
Reservoir, Meade, Kans.	175
Applicants in Kansas	3,035
Martin Pond, Frankfort, Ky.	100
Boyd Pond, Eagle Mills, Ky.	100
Fern Lake, Middleboro, Ky.	100
Crystal Lake, Ryland, Ky.	150
Lake Corinne, Eddyville, Ky.	150
Spring Lake, Louisville, Ky.	200
Slate Creek, Owingsville, Ky.	200
Wilson Creek, Lebanon, Ky.	200
Rolling Fork Creek, Lebanon, Ky.	200
Middle Fork of Red River, Lexington, Ky.	300
Chaplin River, Springfield, Ky.	150
Beach Creek, Springfield, Ky.	100
Spring Lake, Salem, Ky.	150
Dick River, Danville, Ky.	200
Lancaster, Ky.	100
Little River, Hopkinsville, Ky.	200
Lake Clough, Kuttawa, Ky.	200
Slaughters Reservoir, Slaughters, Ky.	150
Elkhorn Creek, Frankfort, Ky.	200
Barren River, Bowling Green, Ky	150
Lake Mingo, Nicholasville, Ky.	100
Kentucky River, Beattyville, Ky.	150
Rockcastle River, Livingston, Ky	200
Applicants in Kentucky	4,900
Red Bayou, Gilliam, La.	100
Cottonwood Bayou, Dixie, La.	100
Lake Martin, Cades, La.	50
Bayou Robert, Alexandria, La.	100
City Park Lake, New Orleans, La	125
Lake Tasse, Jeanerette, La.	50
Artificial Lake, Cypremort, La.	50
Lake Chaplin, Natchitoches, La.	50
Lake Julia, Bermuda, La.	50
Applicants in Louisiana	350
Chesapeake and Delaware Canal, Baltimore, Md	150
Severn River, Waterbury, Md.	150
Monocacy River, Frederick, Md.	600
Spring Lake, Forest Glen, Md.	100
Gunpowder River, Shamburg, Md	150
Little Antietam River, Rockbridge, Md	150
Pocomoke River, Snowhill, Md.	1,500
Black bass—Continued.	
Fred Avon River, Easton, Md.	150
Potomac River, Woodmont, Md.	3,250
Glen Echo, Md.	5,000
Applicants in Maryland	625
Greenland Pond, Brewster, Mass.	200
Oldham Pond, South Hanson, Mass.	200
Singletary Lake, Millbury, Mass.	250
Turner Park Pond, Springfield, Mass.	100
Connecticut River, Holyoke, Mass	100
Silver Lake, Plympton, Mass.	200
Pimlico Pond, Sandwich, Mass	400
Applicants in Massachusetts	100
Deer Lake, Onota, Mich	20
Clark Lake, Watersmeet, Mich.	20
Saddle and Silver lakes, Grand Junction, Mich.	200
Duck Lake, Springport, Mich.	200
Peach and Edwards lakes, Westbranch, Mich	150
Portage Lake, Ypsilanti, Mich.	150
Jones Lake, Lansing, Mich	150
Kettle Lake, Kalkaska, Mich	100
Spring Lake, Coral, Mich.	200
South Branch Tobacco River, Clare, Mich	200
Farm Lake, Lake Station, Mich.	100
Dewey Lake, Clare, Mich.	200
Spring Lake, Spring Lake, Mich.	150
Round Lake, Hanover, Mich.	150
Spring Lake, Silverwood, Mich	100
Pleasant Lake, Leslie, Mich.	300
Little and Big Portage lakes, Dexter, Mich	150
Lane Lake, Marshall, Mich	150
Applicant at Richville, Mich	100
Lake Shetek, Tracy, Minn	200
Lake Minnewaska, Glenwood, Minn.	10
Redwood River Pond, Redwood Falls, Minn	20
Round Pond, Shuqualak, Miss.	140
Anderson Pond, Shuqualak, Miss.	140
Bardwell Pond, Shuqualak, Miss.	280
Jackson Pond, Shuqualak, Miss.	210
Millpond, Shuqualak, Miss	210
Lake Lutz, Canton, Miss.	280
Mitchell Lake, New Albany, Miss.	200
Ford Pond, Waterford, Miss.	300
Mill Pond, Oakland, Miss.	150
Middle Fork Creek, Hamburg, Miss	420
Horseshoe Lake, Aberdeen, Miss.	150
Applicants in Mississippi	10,980
Railroad Reservoir, Willow Springs, Mo.	50
Chick Lake, Excelsior Springs, Mo	150
Spring Lake, Nevada, Mo.	50
Spring Lake, Joplin, Mo	32
Applicants in Missouri	438
Koctenai River, Libby, Mont.	150
Chimney Lake, Toston, Mont.	150
Prairie Grove Lake, Toston, Mont.	150
Fay Lake, Kalispell, Mont	150
Mohn Lake, Kalispell, Mont	150
Echo Lake, Creston, Mont	150
Applicant at Townsend, Mont	150
Frenchman River Millpond, Imperial, Nebr	25
Seymour Lake, Seymour Park, Nebr.	30
Spring Lake, Grand Island, Nebr.	25
Applicant at Tobias, Nebr	25
Crystal Lake, Concord, N. H.	450
Decker Pond, Boonton, N. J	150
Jaquic Lake, Morris Plains, N. J.	100
Prickett Millpond, Woodbury, N. J	150
Lenapee Lake, Blair, N. J	150
Millstone River, Princeton Junction, N. J	150

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Falcon Lake, Sicklertown, N. J	150
Reservoir, Socorro, N. Mex	50
Lake Van, Hagerman, N. Mex	100
Lake LaCueva, Raton, N. Mex	100
Willow Lake, Malaga, N. Mex	50
Gila River, Silver City, N. Mex	100
Rio Grande River, N. Mex.—	
Bernalillo	100
Thornton	100
Espanola	100
Embudo	100
Spring Lake, Springer, N. Mex	100
Reservoir, Santa Fe, N. Mex	50
Indian School Pond, Tularosa, N. Mex	50
Marian Lake, Gallup, N. Mex	100
Applicants in New Mexico	200
Tuscarora River, Wilson, N. Y	600
Canisteo River, Addison, N. Y	200
Round Lake, Monroe, N. Y	400
Summit and Twin lakes, Central Village, N. Y	400
Cromwell Lake, Highland Mills, N. Y	200
Potagu Lake, Sterlington, N. Y	150
Lake Cuba, Cuba, N. Y	200
Spring Lake, Briarcliff Manor, N. Y	150
Lake and stream, Sterlington, N. Y	150
Wallkill Creek, New Paltz, N. Y	150
Salmon River, Fort Covington, N. Y	500
Mountain Lake, Sullivan County, N. Y	150
Schroon Lake, Riverside, N. Y	500
Williamsville Fishponds, Williamsville, N. Y	400
Far Pond, Shinnecock Hills, N. Y	100
New Pond, Fayetteville, N. C	100
Briny Branch, Fayetteville, N. C	100
Carver Pond, Fayetteville, N. C	100
Blount Creek, Fayetteville, N. C	100
Little Alamance Creek, Burlington, N. C	100
Rocky River, Harrisburg, N. C	100
Ruin Creek, Oxford, N. C	100
Pigeon River, Canton, N. C	100
Fairfield Lake, Brevard, N. C	150
Rule's Old Pond, Warren Plains, N. C	100
King's Mountain Pond, Grover, N. C	100
Swift Creek, Clayton, N. C	100
Ladd Creek Millpond, Pinehall, N. C	100
Spring Creek, Wilkesboro, N. C	100
Bleven Branch, Cranberry, N. C	100
Applicants in North Carolina	2,700
Spiritwood Lake, Jamestown, N. Dak	2,100
Willow Lake, Coopertown, N. Dak	150
Lake Hiawatha, Sykeston, N. Dak	80
Devils Lake, Devils Lake, N. Dak	375
Stump Lake, Lakota, N. Dak	380
Applicant at Edgerly, N. Dak	150
Rockfork Creek, Newark, Ohio	150
Hocking River, Nelsonville, Ohio	150
Miami River, Dayton, Ohio	550
Spring Lake, Aurora, Ohio	150
Grand River, Painsville, Ohio	150
Stream at Portsmouth, Ohio	200
Muth Lake, Cumminsville, Ohio	200
Mill Creek, Wyoming, Ohio	200
Long Pond, Moran, Ohio	100
Cuyahoga River, Mantua, Ohio	150
Whitewater River, Harrison, Ohio	200
Odell Lake, Lakeville, Ohio	100
Mad River, West Liberty, Ohio	150
Olentangy and Scioto Rivers, Marion, Ohio	250

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Grand River, East Orwell, Ohio	150
Lake Pippin, Brady Lake, Ohio	165
Stillwater River, West Wilton, Ohio	200
Congress Lake, Congress Lake, Ohio	2,755
Applicants in Ohio	1,340
Willow Pond, Perry, Okla	50
Crutcho Creek, Oklahoma, Okla	50
Little Deer Lake, Weatherford, Okla	200
Applicants in Oklahoma	1,650
Juniata River, Sprucecreek, Pa	66
Juniata River, Huntingdon, Pa	133
Delaware River, Shohola, Pa	300
Crystal Lake, Carbondale, Pa	200
Sims Pond, Masthope, Pa	150
Lake Teedyuskung, Rowland, Pa	150
Beaverdam Creek, Coalport, Pa	66
Swatara Creek, Tremont, Pa	150
Tulpehocken Creek, Reading, Pa	200
Forest Lake, East Stroudsburg, Pa	200
Mud Lake, East Stroudsburg, Pa	200
Lake Taminent, East Stroudsburg, Pa	200
Lake Minisink, East Stroudsburg, Pa	150
Spring Creek, Elverson, Pa	50
Schuylkill River, Norristown, Pa	75
Perkiomen Creek, Norristown, Pa	75
Pickering Creek, Phoenixville, Pa	50
Lake Memeta, Wernersville, Pa	50
Mountain Lake, Troy, Pa	150
Lake Silkworth, Plymouth, Pa	150
Fulton Millpond, Everett, Pa	130
Spruce Creek, Sprucecreek, Pa	50
Wrighter and Dunn lakes, Thompson, Pa	150
Coxtown and Comfort lakes, Thompson, Pa	150
Honeoye Creek, Shinglehouse, Pa	200
Triangular Lake, Wilkesbarre, Pa	750
Pennypack Creek, Hatboro, Pa	75
Reservoir, McDonald, Pa	33
Harvey Lake, Harvey Lake, Pa	200
Susquehanna River, Susquehanna, Pa	375
Spring Lake, Edinboro, Pa	50
Allegheny River, Kittanning, Pa	66
Lake Lebouff, Waterford, Pa	50
Green Pond, Port Carbon, Pa	150
Ridley Creek, Media, Pa	50
Brandywine Creek, Chadds Ford, Pa	50
Elk Lake, Alford, Pa	150
Moosic Lake, Wimmer, Pa	150
Aughwick River, Huntingdon, Pa	50
Stone Creek, Huntingdon, Pa	66
Stone Creek and tributaries, Johnstown, Pa	50
Applicants in Pennsylvania	225
Bowen Pond, Riverside, R. I	200
Stillwater Pond, Stillwater, R. I	225
Yorker Pond, Kingston, R. I	200
Silver Lake, Wakefield, R. I	200
Applicant at Wickford, R. I	150
Rhode Island Fish Commission, Westerly, R. I	1,000
Mountain Creek, Greenville, S. C	100
Broad River, Hickory Grove, S. C	150
Anderson Millpond, Harrold, S. C	75
Willow Pond, Abbeville, S. C	100
Fairforest Creek, Spartanburg, S. C	100
Millpond, Spartanburg, S. C	100
Ingleside Lake, Charleston, S. C	100
Little River, Honeapath, S. C	50
Suggs Millpond, Sanford, S. C	150
Applicants in South Carolina	1,075

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Water company's reservoir, Sturgis, S. Dak	25
Sylvan Lake, Custer, S. Dak	25
Spring Brook, Spearfish, S. Dak	20
Lake Hendricks, White, S. Dak	100
Artificial lake, Tripp, S. Dak	200
Pickerd Lake, Webster, S. Dak	150
Fish Lake, Armour, S. Dak	150
Clear Lake, Clear Lake, S. Dak	250
Foot-Creek, Aberdeen, S. Dak	200
Vermilion River, Montrose, S. Dak	200
Applicants in South Dakota	540
Millpond, Winchester, Tenn	50
Barren Fork River, McMinnville, Tenn	200
Paint Creek, Greenville, Tenn	200
Nine-Mile Creek, McGhee, Tenn	150
Spring Lake, McGhee, Tenn	150
Watauga River, Watauga, Tenn	500
Poplar Creek, Clinton, Tenn	100
Mountain Lake, Leas Springs, Tenn	100
Tributaries of Cumberland River, Jellico, Tenn	200
Millpond, Cedarhill, Tenn	20
Springdale Park Lake, Covington, Tenn	150
Oakview Pond, Gibson, Tenn	100
Willow Pond, Gibson, Tenn	250
Big Creek, Rogersville, Tenn	80
Flint River, Fayetteville, Tenn	150
Cane Creek, Fayetteville, Tenn	100
Fall Creek, Russellville, Tenn	100
Sequahatchie River, Dunlap, Tenn	150
Big Creek, Del Rio, Tenn	100
Bent Creek, Whitesburg, Tenn	100
Millpond, Lawrenceburg, Tenn	100
Duck River, Lewisburg, Tenn	200
Spring Creek, Normandy, Tenn	20
Spring Lake, Woodstock, Tenn	150
Electric Lake, Chattanooga, Tenn	340
Watauga River, Elizabethton, Tenn	250
Pinewood Lake, Clarksville, Tenn	20
Applicants in Tennessee	1,510
Lake Thorne, Longview, Tex	550
Hill Lake, Longview, Tex	600
Horseshoe Lake, Longview, Tex	200
Fish Lake, Overton, Tex	300
Spring Lake, Overton, Tex	300
Graham and Allen Lakes, Overton, Tex	1,000
Clear Creek, Stone, Tex	500
Rucker Lake, Farmville, Tex	100
Asylum Lake, Austin, Tex	125
Middle Lake, Georgetown, Tex	300
San Gabriel River, Georgetown, Tex	1,100
Cypress Creek, Marble Falls, Tex	100
Artificial lake, Kenedy, Tex	1,500
Highland Lake, Palestine, Tex	100
Jackson Lake, Palestine, Tex	100
Cartmell Lake, Palestine, Tex	200
Lake Leroy, Palestine, Tex	100
Waterworks Lake, Palestine, Tex	1,030
Lake McDonough, Phelps, Tex	1,000
Chittopin Creek, Sinton, Tex	500
Field Creek, Llano, Tex	75
El Caney Pond, Crockett, Tex	600
Lakeside Lake, Marshall, Tex	125
Bonita Lake, Marshall, Tex	1,000
Kate Era Lake, Marshall, Tex	1,000
Artificial lake, Cleburne, Tex	150
Trinity Rod and Gun Club lakes, Dallas, Tex	1,500
Exall Lake, Dallas, Tex	500
Brown Tank, Wylie, Tex	75
Reservoir, Lufkin, Tex	400
Fish Lake, Lufkin, Tex	500

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Lake Thorn, Waskom, Tex	300
Artificial lake, Orphans Home, Tex	150
Reservoir, Alice, Tex	150
Panther Creek Millpond, Memphis, Tex	100
Spring Lake, Terrell, Tex	450
Rito Blanca Creek, Channing, Tex	1,000
Giles Lake, Mineola, Tex	100
Spring Lake, Eskota, Tex	150
Mason Lake, Duke, Tex	1,000
Clear Lake, Duke, Tex	1,800
Natural Lake, Panhandle, Tex	1,700
Salado Creek, San Antonio, Tex	300
Salado and Santa Rosa creeks, Monahans, Tex	1,900
San Antonio River, San Antonio, Tex	4,000
Alazan Creek, San Antonio, Tex	200
San Pedro Springs, San Antonio, Tex	100
Tecovas Creek, Amarillo, Tex	1,150
Champion Creek, Loraine, Tex	200
Pope Creek, Honeygrove, Tex	150
City reservoir, Honeygrove, Tex	75
Chief Lake, Taylor, Tex	200
Brushy Lake, Taylor, Tex	125
Fish Pond, Iatan, Tex	500
South Fork Washita River, Canadian, Tex	500
Clear Creek, Canadian, Tex	500
John Creek, Canadian, Tex	200
Washita River, Canadian, Tex	1,500
Big Timber Lake, Canadian, Tex	150
Williams Creek, Canadian, Tex	500
Johnson Hole, Abilene, Tex	300
Horsehead Creek, Abilene, Tex	450
Lytle Lake, Abilene, Tex	475
Mannewitzer Lake, Abilene, Tex	300
Cameron Dam, Abilene, Tex	200
Steffen Lake, Abilene, Tex	300
Clack Pool, Abilene, Tex	300
Thompson Pool, Abilene, Tex	300
Rainy Creek, Abilene, Tex	1,300
Swan Lake, Abilene, Tex	300
Fish Lake, Dundee, Tex	200
Lake Polk, Temple, Tex	800
Doe Creek, Memphis, Tex	300
Lake Katrine, Timpson, Tex	125
Shipp Lake, Smithville, Tex	1,000
Lake Sandhill, Jonesville, Tex	1,000
Lake Eloise, Waco, Tex	400
Spring Lake, Yorktown, Tex	500
Spring Lake, Nacogdoches, Tex	100
Fern Lake, Nacogdoches, Tex	3,300
Taylor Mill Pond, Nacogdoches, Tex	300
Tubbs Mill Pond, Nacogdoches, Tex	300
Waterworks Pond, Nacogdoches, Tex	200
Poe Lake, Nacogdoches, Tex	1,000
Cantonment Creek, Miami, Tex	500
Chicken Creek, Miami, Tex	600
Spring Creek, Miami, Tex	500
Jones Creek, Miami, Tex	500
Maine Call Creek, Miami, Tex	300
Turner Creek, Miami, Tex	300
Dugout Creek, Miami, Tex	400
Conch Creek, Miami, Tex	300
Bass Lake, Wichita Falls, Tex	1,000
Lake Wichita, Wichita Falls, Tex	1,000
Spring Lake, Higgins, Tex	125
Long Creek, Higgins, Tex	125
Benson Fork of Red River, Canyon City, Tex	1,000
Bass Lake, Canyon City, Tex	1,000
Spring Lake, Henrietta, Tex	300
Reilly Lake, Iowa Park, Tex	5,000
Fish Lake, Claude, Tex	1,000
White Deer Creek, Pampa, Tex	1,000
Santa Fe Lake, Celeste, Tex	2,075
Stream at Weatherford, Tex	500

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Mann Lake, Weatherford, Tex	150
Pedernales River, Fredericksburg, Tex	4,000
Little Brazos River, Hearne, Tex	500
Bear, Slaughter and Onion creeks Manchaca, Tex	450
Wildcat Creek, Vernon, Tex	450
Spring Creek, Victoria, Tex	200
Railroad Reservoir, Moore, Tex	1,000
Colorado and Llano rivers, Kingsland, Tex	2,500
Birdwell Lake, Bigsprings, Tex	225
Applicants in Texas	13,205
North Pond, Johnson, Vt	200
Hinesburg Pond, Williston, Vt	200
Millpond, South Londonderry, Vt	200
Great Back Bay, St. Albans, Vt	200
Lake Hortonia, Brandon, Vt	200
Potomac River, Dayesville, Va	100
Millpond, Roxbury, Va	50
Reservoir, Petersburg, Va	100
Rawlett Millpond, Petersburg, Va	100
Lees Pond, Petersburg, Va	100
Baxter Pond, Petersburg, Va	200
Totty Millpond, Petersburg, Va	100
Brander Millpond, Petersburg, Va	50
Falls Branch, Cleveland, Va	50
Vanity Millpond, Arrington, Va	50
Merriken Lake, Staunton, Va	50
Middle River, Staunton, Va	100
Jones Lake, Guinea, Va	100
Licking Creek Pond, Fairoaks, Va	200
Holly Springs, Cotman, Va	50
Hughs River, Culpeper, Va	100
Corbon Pond, Avalon, Va	100
Tinker Creek, Hollins, Va	100
Cedar Run, Catletts, Va	100
Stony Creek, Edinburg, Va	100
Stinting River, Franklin Junction, Va	100
Banister River, Franklin Junction, Va	400
Allen Creek, Franklin Junction, Va	100
Sharcoe Creek, Franklin Junction, Va	100
Whitethorn Creek, Franklin Junction, Va	100
West Fork Shenandoah River, Strasburg Junction, Va	100
Finches Millpond Goochland, Va	25
Spring Lake, Esmont, Va	50
Maplewood Pond, Richmond, Va	75
Spring Lake, Richmond, Va	100
Mordecai Pond, Richmond, Va	100
Edgemeer Pond, Richmond, Va	100
Spring Lake, Richmond, Va	300
Granite Lake, Richmond, Va	150
Little River, Pulaski, Va	100
Ice Pond, Urbanna, Va	100
Rappahannock River, Remington, Va	100
Millpond, Burkeville, Va	100
Goose Creek, Plains, Va	300
Buttonwood Creek, Ford, Va	100
Little River, Beaverdam, Va	100
Bluestone Creek, Graham, Va	200
Rock Hill Lake, Charlottesville, Va	50
Reservoir, Harrisonburg, Va	50
Sugar Creek, Herndon, Va	100
James River, Glengyle, Va	100
Balcony Falls, Va	70
Gilmores Mills, Va	100
Granite Lake, Chesterfield, Va	50
Shenandoah River, Boyce, Va	200
Page Spring, Boyce, Va	1,000
Wirt Millpond, Oakgrove, Va	400
Millpond and Jones Branch, Providence Forge, Va	300
Black bass—Continued.	
Pohoke Pond, Whitehouse, Va	500
Denton Pond, Doswell, Va	200
Jones Creek, Dispatch, Va	300
Stubbs Millpond, Sassafras, Va	200
South Fork Roanoke River, Shawsville, Va	300
Cave Creek, Wytheville, Va	1,200
Tate Run, Wytheville, Va	2,500
Tinker Creek, Hollins, Va	800
Applicants in Virginia	3,125
Opequan Creek, Martinsburg, W. Va	200
Tuscarora Creek, Martinsburg, W. Va	400
Shenandoah River, Charlestown, W. Va	500
Elk River, Charleston, W. Va	50
Little Kanawha River, Fishing Camp, W. Va	60
Tug River, Williamson, W. Va	80
Cheat River, Parsons, W. Va	200
Applicant at Harpers Ferry, W. Va	100
Elbow and Newton lakes, Athelstane, Wis	30
Pike Lake, Iron River, Wis	10
Yellow River, Necedah, Wis	20
Applicant at Augusta, Wis	10
Lake Desmet, Sheridan, Wyo	35
Reservoir at Taylor, Ontario, Canada	150
Piedras Verdes River, Colonia Juarez, Mexico	2,500
Total	228,105
Crappie:	
Millpond, Dothan, Ala	50
Ingram Millpond, Opelika, Ala	90
Millpond, Waverly, Ala	45
Hill Lake, Eufaula, Ala	225
Frog Creek, Rock Run, Ala	75
Bethea Lake, Faunsdale, Ala	100
Applicants in Alabama	1,005
Lake Como, Como, Fla	200
Waterworks Lake, Marietta, Ga	30
Fouche Pond, Rome, Ga	25
Clemmons Millpond, Summerville, Ga	75
Shropshire Millpond, Summerville, Ga	50
Norton Creek, Jasper, Ga	300
Dennis Creek, Neda, Ga	106
Reservoir, Atlanta, Ga	100
Lakewood Lake, Atlanta, Ga	15
Burpee Millpond, Newnan, Ga	15
Big Spring, Calhoun, Ga	15
Hall Lake, Calhoun, Ga	15
Charlie Creek Dam, Blue Ridge, Ga	50
Lake Clara Meer, Atlanta, Ga	15
Spring Lake, Jasper, Ga	150
East Lake, Atlanta, Ga	15
Applicants in Georgia	1,035
Spring Lake, Oakland, Ill	40
Pistakee Lake, McHenry, Ill	30
Channel Lake, Antioch, Ill	40
Long Lake, Long Lake, Ill	50
Millpond, Germantown, Ill	180
Clear Lake, Germantown, Ill	180
Clement Lake, Danville, Ill	100
Grays Lake, Grayslake, Ill	50
Pistakee Bay, Nippersink, Ill	700
Sangamon River, Decatur, Ill	500
Applicants in Illinois	485
Cedar River, Orchard, Iowa	200
Charles City, Iowa	200
Maquoketa River, Dundee, Iowa	75
Manchester, Iowa	79
North Fork, Maquoketa River, Worthington, Iowa	175
Upper Iowa River, Chester, Iowa	50

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Crappie—Continued.	
Crane Creek, Chester, Iowa	50
Volga River, Fayette, Iowa	50
Little Turkey River, Navan, Iowa	50
Applicants in Iowa	1,200
Reservoir, Kendall, Kans	200
Applicants in Kansas	50
Greenwood Lake, Greenwood, La	100
Deer Lake, Onota, Mich	200
Clark Lake, Watersmeet, Mich	100
Eagle Lake, Willmar, Minn	200
Lake Minnewaska, Glenwood, Minn	200
Redwood River Pond, Redwood Falls, Minn	200
Chick Lake, Excelsior Springs, Mo	150
Applicant at Perryville, Mo	50
Frenchman River Millpond, Imperial, Nebr	100
Seymour Lake, Seymour Park, Nebr	100
Spring Lake, Grand Island, Nebr	100
Applicant at Tobias, Nebr	100
Spiritwood Lake, Jamestown, N. Dak	300
Devils Lake, Devils Lake, N. Dak	96
Stump Lake, Lakota, N. Dak	96
Stillwater River, West Wilton, Ohio	100
Congress Lake, Congress Lake, Ohio	1,800
Lake Erie, Cleveland, Ohio	300
Lake Hendricks, White, S. Dak	200
Sylvan Lake, Custer, S. Dak	100
Water Company's Reservoir, Sturgis, S. Dak	125
Spring Brook, Spearfish, S. Dak	100
Applicant at Castalia, S. Dak	300
Lake Blanche, Austin, Tex	200
Spring Pond, Thurber Junction, Tex	300
Chicken Creek, Amarillo, Tex	100
Berry Creek, Georgetown, Tex	100
Middle Lake, Georgetown, Tex	150
San Gabriel River, Georgetown, Tex	700
Lake Farrar, Ennis, Tex	100
Spring Lake, Ennis, Tex	275
Cotton Oil Company's Pond, Kaufman, Tex	100
Guadalupe River, Kerrville, Tex	930
Spring Creek, Victoria, Tex	100
Spring Lake, Waco, Tex	250
Lake Eloise, Waco, Tex	300
Bold Spring Lake, Waco, Tex	100
Reservoir, Cuero, Tex	50
Lone Pine Lake, Cooper, Tex	50
Llano River, Llano, Tex	450
Colorado River, Kingsland, Tex	300
El Caney Lake, Crockett, Tex	200
Artificial Lake, Naples, Tex	75
Trinity Rod and Gun Club Lake, Dallas, Tex	500
Colorado River, Fairland, Tex	300
Hamilton and Morgan creeks, Burnett, Tex	300
Graham and Allen lakes, Overton, Tex	300
Giles Lake, Mineola, Tex	200
Salado Creek, San Antonio, Tex	300
San Antonio River, San Antonio, Tex	100
Hust Lake, Fort Worth, Tex	200
Lake Katrine, Timpson, Tex	75
Pine Lake, Palestine, Tex	100
Spring Lake, Palestine, Tex	350
Moore Lake, Moore, Tex	200
Railroad Reservoir, Moore, Tex	50
Nueces River, Cotulla, Tex	500
Cold Spring Lake, Yoakum, Tex	150
Beaver Creek, Burnett, Tex	100
Lake Kyle, Kyle, Tex	50
Crappie—Continued.	
Lake Hayes, Marshall, Tex	100
Applicants in Texas	3,740
James River, Gilmores Mills, Va	35
Glengyle, Va	150
Balcony Falls, Va	100
Buffalo Creek, Fairmont, W. Va	72
Wheeling Creek, Elmgrove, W. Va	240
Elk River, Charleston, W. Va	100
Hughes River, Pennsboro, W. Va	96
Little Kanawha River, Fishing Camp, W. Va	480
Tug River, Williamson, W. Va	75
Quarry Lake, Cornwallis, W. Va	72
Elbow and Newton lakes, Athelstane, Wis	250
Pike Lake, Iron River, Wis	100
Yellow River, Necedah, Wis	125
Applicant at Augusta, Wis	50
Lake Desmet, Sheridan, Wyo	300
Big Goose Creek, Sheridan, Wyo	2,125
Total	30,467
Rock bass:	
Ingram Millpond, Opelika, Ala	400
Millpond, Opelika, Ala	150
Applicants in Alabama	1,050
Applicants in Arkansas	100
Applicants in Delaware	150
Spring Branch, Mount Pleasant, Fla	50
Hudson Pond, Tucker, Ga	50
Millpond, Cuthbert, Ga	50
Applicants in Georgia	850
Sulphur Creek, Sulphur, Ind. T	250
Applicants in Indian Territory	100
Smoky Hill River, Enterprise, Kans	300
Reservoir, Kendall, Kans	200
Waldock Lake, Pratt, Kans	200
Crooked Creek, Fowler, Kans	75
Spring Creek, Meade, Kans	25
Reservoir, Meade, Kans	200
Little Arkansas River, Wichita, Kans	300
Solomon River, Minneapolis, Kans	300
Wea and Bull creeks, Paoli, Kans	500
Elk and Cana rivers, Grenola, Kans	300
Forest Lake, Bonner Springs, Kans	200
John Creek, Ashland, Kans	300
Applicants in Kansas	3,100
Applicant in Louisiana	100
Locust Run, Mechanicsville, Md	100
Branch of Patuxent River, Laurel, Md	226
Applicant in Maryland	100
Cut-off Lake, Brunswick, Mo	200
Clay Lake, Jefferson City, Mo	150
Spring Lake, Nevada, Mo	200
Spring Lake, Joplin, Mo	445
James River, Aurora, Mo	100
Applicants in Missouri	400
Prickett Mill Pond, Woodbury, N. J	100
Reservoir, Folsom, N. Mex	100
Applicant at Deming, N. Mex	300
Ewen Creek, Pinehall, N. C	150
Beaver Lake, Fayetteville, N. C	250
Twitle Pond, Roxboro, N. C	85
Lochlily Pond, Roxboro, N. C	85
Rogers Lake, Warren Plains, N. C	120
King's Mountain Pond, Grover, N. C	100
Fish Club Pond, Wilson, N. C	150
Applicants in North Carolina	600
Little Deer Lake, Weatherford, Okla	100

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Rock bass—Continued.	
Applicants in Oklahoma	800
Lake Rowena, Ebensburg, Pa	100
Ridley Creek, Media, Pa	100
Brandywine Creek, Westchester, Pa	200
Dorland, Pa	300
Pennypack Creek, Hatboro, Pa	100
Applicants in Pennsylvania	100
Applicants in South Carolina	350
Millpond, Newport, Tenn	100
Toms Creek, Del Rio, Tenn	100
Cedar Creek, Coalcreek, Tenn	50
Doe River, Elizabethton, Tenn	200
Applicants in Tennessee	550
Chicken Creek, Amarillo, Tex	275
Cypress Creek, Marble Falls, Tex	250
Dry Creek, Richmond, Tex	700
Big Creek, Richmond, Tex	725
Rogers Lake, Corpus Christi, Tex	300
Lakes in North Creek, Canadian, Tex	100
Washita River, Canadian, Tex	100
Colony Fork Reservoir, Ranger, Tex	225
Bold Springs Lake, Waco, Tex	75
Onion Creek, Kyle, Tex	200
Lake McDonough, Phelps, Tex	400
Clear Fork Trinity River, Fort Worth, Tex	100
Spring Lake, Ennis, Tex	400
Cold Spring Lake, Yoakum, Tex	75
San Antonio River, San Antonio, Tex	300
Guadalupe River, San Antonio, Tex	100
San Marcos River, San Marcos, Tex	500
Applicants in Texas	3,440
Tinker Creek, Roanoke, Va	100
Hollins, Va	100
Chinn Creek, Plains, Va	100
Maplewood Pond, Richmond, Va	100
Reedy Creek, Ford, Va	100
Whiteoak Creek, Ford, Va	100
Buttonwood Creek, Ford, Va	400
Tate Run, Wytheville, Va	155
Applicants in Virginia	1,200
Applicant at Bluefield, W. Va	100
Total	27,131
Strawberry bass:	
Bull Bayou, Hot Springs, Ark	100
Applicants in Indian Territory	200
Crooked Lake, Fowler, Kans	50
Reservoir, Meade, Kans	150
John Creek, Ashland, Kans	200
Applicants in Kansas	300
Lake Martin, Cades, La	125
Foster Lake, Shreveport, La	200
Bayou Robert, Alexandria, La	125
Lake Chaplin, Natchitoches, La	150
Lake Julia, Bermuda, La	150
Applicants in Louisiana	225
James River, Aurora, Mo	300
Clay Lake, Jefferson City, Mo	100
Willow Pond, Perry, Okla	100
Lake Hayes, Marshall, Tex	100
Total	2,575

Species and disposition.	Adults and yearlings.
Warmouth bass:	
Warm and Cold Springs creeks, Bullochville, Ga	306
Pistakee Lake, McHenry, Ill	20
Clements Lake, Danville, Ill	150
Pistakee Bay, Nippersink, Ill	300
Applicants in Illinois	80
James River, Gilmores Mills, Va	25
Glengyle, Va	100
Balcony Falls, Va	50
Total	1,031
Sun-fish:	
Pistakee Lake, McHenry, Ill	20
Clement Lake, Danville, Ill	150
Pistakee Bay, Nippersink, Ill	100
Applicants in Illinois	105
Stump Lake, Lakota, N. Dak	32
Devils Lake, Devils Lake, N. Dak	33
James River, Gilmores Mills, Va	40
Glengyle, Va	200
Balcony Falls, Va	150
Little Kanawha River, Fishing Camp, W. Va	180
Total	1,010
Bream:	
Hill Lake, Eufaula, Ala	400
Silver Lake, Seale, Ala	150
Euchre Creek, Seale, Ala	200
Tadlock Lake, Seale, Ala	100
Applicants in Alabama	400
Soap Creek, Marietta, Ga	100
Warm Springs Creek, Bullochville, Ga	258
Bowden Millpond, Raleigh, Ga	100
Mallory Pond, Forsyth, Ga	100
Crystal Lake, Cuthbert, Ga	100
Ocmulgee River, Juliette, Ga	150
Spring Lake, Macon, Ga	300
Ingleside Lake, Macon, Ga	100
Lake Benson, White Sulphur Springs, Ga	100
Warm and Cold Springs creeks, Bullochville, Ga	267
Applicants in Georgia	450
Crooked Creek, Fowler, Kans	400
Spring Creek, Meade, Kans	100
Reservoir, Meade, Kans	500
Applicants in Kansas	700
Applicants in Louisiana	400
Spring Branch, Neosho, Mo	3,430
Shawver Lake, Seymour, Tex	150
Seymour Creek, Seymour, Tex	400
Clear Fork of Trinity River, Fort Worth, Tex	350
Trinity River, Fort Worth, Tex	650
San Antonio River, San Antonio, Tex	1,500
San Marcos River, San Marcos, Tex	1,000
Colorado River, Marble Falls, Tex	1,000
Lake Kyle, Kyle, Tex	100
Applicants in Texas	2,545
Total	16,500

Details of distribution—Continued.

Species and disposition.	Fry.
Cod:	
Vineyard Sound, Mass.—	
At mouth	1,406,000
Off Robinson Hole, Mass	4,869,000
Tarpaulin Cove, Mass	36,106,000
Jobs Neck, Mass	27,693,000
Gayhead, Mass	15,370,000
Waquoit, Mass	4,020,000
Lackey Bay, Mass	7,155,000
Can Buoy, Mass	3,271,000
Atlantic Ocean, Gloucester, Mass	96,541,000
Beverly, Mass	3,925,000
Eel Pond, Woods Hole, Mass	1,558,000
Green Pond, Falmouth, Mass	957,000
Total	202,871,000
Flat-fish:	
Woods Hole Harbor—	
Off Woods Hole, Mass	32,495,000
Grassy Island, Mass	1,527,000
Lackey Bay, Mass	585,090
Green Pond, East Falmouth, Mass	3,313,000
Great Pond, East Falmouth, Mass	1,523,000
Vineyard Sound, Lambert Cove, Mass	1,681,000
Hadley Harbor, Naushon Island, Mass	2,668,000
Acushnet Harbor, New Bedford, Mass	438,000
Total	44,230,000
Lobster:	
Fisher Island Sound, off Noank, Conn	727,000
Gulf of Maine—	
Off Cape Porpoise Light, Me	750,000
Between Heron and Damascus Cove islands, Me	250,000
Northeast shore Georges Island, Me	1,000,000
Off southeast shore Mosquito Island, Me	1,000,000
Northeast side Seal Harbor, Me	1,000,000
Southeast side Owls Head Bay, Me	500,000
Wood Island Harbor, Me	600,000
Off Deer Island, Me	250,000
Lunts Harbor, Long Island, Me	250,000
Lobster—Continued.	
North shore Long Island, Me	250,000
Between Schoodic and Petit Manan, Me	250,000
Cutler Harbor, Me	250,000
Johnson Bay, Me	150,000
Boothbay Bay, off Cape Newagen, Me	250,000
Casco Bay—	
Off Small Point, Me	250,000
Near north point Long Island, Me	1,100,000
South shore Great Diamond Island, Me	1,100,000
Off south shore Cow Island, Me	1,500,000
Midway between Peaks and Long islands, Me	1,500,000
Near west shore Peaks Island, Me	1,300,000
Near south shore Little Diamond Island, Me	1,500,000
Woods Hole Harbor—	
Woods Hole, Mass	1,975,000
Off Grassy Island, Mass	1,524,000
Devils Foot Island, Mass	572,000
Vineyard Sound, off—	
Cedartree Neck, Mass	1,165,000
Nobska Point, Mass	624,000
Great Ledge, Mass	585,000
Woods Hole Harbor, Mass	798,000
Atlantic Ocean, Gloucester, Mass	23,370,000
off Scituate Harbor, Mass	1,423,000
Beverly, Mass	2,450,000
Rockport, Mass	2,800,000
Lanesville, Mass	1,850,000
Barnstable Harbor, Barnstable, Mass	986,000
Cape Cod Bay, off Manomet, Mass	646,000
Buzzards Bay, off Weepecket Island, Mass	787,000
Long Neck, Mass	531,000
Massachusetts Bay, east of Minots Light, Mass	1,800,000
Newport Harbor, Newport, R. I.	1,266,000
Total	60,879,000

COLD SPRING—PART OF WATER SUPPLY AT BULLOCKVILLE

REPORT ON THE INQUIRY RESPECTING FOOD-FISHES AND THE FISHING-GROUNDS.

By Hugh M. Smith, *Assistant in Charge.*

RIVER AND LAKE FISHES OF MAINE.

The fresh-water inquiries in Maine, referred to in previous reports, were continued in 1900 by Dr. William C. Kendall. In the latter part of the summer and early fall the Sebago Lake region was visited, principally with a view to obtain further data on the spawning of the native salmon (*Salmo sebago*). It was observed that there are distinct spring and fall runs of these fish into the streams for feeding and breeding purposes respectively. The spring salmon enter the streams in pursuit of smelts, and at that time will take the hook. They return to the lake with the downward movement of smelts. The fall fish very seldom bite. These facts suggest an explanation of similar habits in the sea salmon. The early sea salmon take the hook, while fall salmon seldom, if ever, do. It is quite possible that the early run is for feeding purposes. The fact that food is seldom found in the stomachs is not proof that the salmon do not feed, for after confinement in traps or when caught in gill nets they naturally get rid of their stomach contents, perhaps by disgorging, but more likely by digestion.

Some interesting notes were obtained on the habits of fresh-water smelt in Sebago and Little Sebago lakes. Later Lake Auburn was visited and a collection of the native fishes was made. Here Hon. H. O. Stanley, one of the State fish commissioners, rendered assistance in various ways. A short trip was made to the Rangeley Lakes, in order, if possible, to study and collect the blueback trout (*Salvelinus oquassa*), but only one specimen was obtained. The fish have become scarce almost to extinction, but in the last ten years they seem to have changed their habits to some extent and have increased in size. Formerly a fish 10 inches long was the largest, and a weight of one-fourth of a pound was probably the heaviest. The specimens now caught on fly or spoon, or by bait-fishing at the bottom, weigh as much as 2½ pounds This increase in size is ascribed to the abundance of smelts, the result of the plants made about 1891.

Sebec Lake, one of the original landlocked-salmon lakes, was also visited. It was learned that there the salmon had the same migratory habits as the Sebago fish. From there Dr. Kendall went to Matagamon or Grand Lake, near the headwaters of the east branch of the Penobscot. A few years ago a gentleman from New York called at the Fish Commission Office in Washington to ascertain the identity

of some small trout or salmon-like fish that he had caught at the upper end of the east branch below the foot of Grand Lake. He reported that they ran from 6 to 10 inches long and were sexually mature at that size. These interesting fish seemed to be identical with the small salmon found in the Presumpscot River below Sebago Lake. A specimen of a ripe male only 6 inches long was obtained. No adult salmon were observed there, though it was learned that not longer than four years ago they were plentiful on the spawning-grounds within 2 miles of the dam at the foot of Matagamon Lake.

At least 17 species of fishes inhabit Matagamon Lake and neighboring waters. At one haul of a 12-foot seine in the mouth of a small brook 12 species were obtained. Of these, 3 were previously unknown from Maine waters, and the recorded range of 4 more was extended. The most interesting feature of this collection scientifically was the discovery of 2 unrecognized species of the minnow *Leuciscus* and the occurrence of the minnow *Notropis muskoka*, previously recorded only from Muskoka Lake, Ontario, together with the finding of the "shore-fish" (*Fundulus diaphanus*), the stickleback (*Gasterosteus atkinsii*), and the chub (*Semotilus atromaculatus*) in these new localities.

Incidental to the clam-planting experiments on Casco Bay, a number of interesting observations were made in the Harraseekett River, a tidal estuary. The usual littoral fishes of the region were found in abundance. Young blue-fish (*Pomatomus*) were very common, and some had been seen the previous season, when they were supposed by fishermen to be butter-fish (*Poronotus*). Their presence in such large numbers is remarkable, since adults of this species have not been noticed in these waters, and only now and then has one been caught in pound-nets in the outer waters of Casco Bay. In October young menhaden (*Brevoortia*) from 3.75 to 4.75 inches long were seined, and were also observed in brush weirs. The young of this species had not before been positively known to occur on the Maine coast. White perch (*Morone*) were uncommonly numerous, and the fishermen, owing to their unfamiliarity with the species because of its previous scarcity, identified it as the sea bass. On October 21 a jumping mullet (*Mugil cephalus*) was taken in a weir, this being the first record of the occurrence of this southern species in Maine waters.

MODEL STUDY OF AN INDIANA LAKE.

In the summer of 1899 the Commission began a physical and biological survey of Lake Maxinkuckee, Indiana, the desire being to make such a study of this lake as would serve as a model for the investigation of all similar lakes. The objects and scope of this inquiry are indicated in the report for 1900. It very early became manifest that satisfactory data concerning many of the problems that came up for consideration could be secured only by carrying on the observations throughout at least one entire year. Therefore, when the

work was resumed July 1, 1900, it was with the intention to continue as many of the lines of observation as possible until July, 1901.

The investigations were again placed under the direction of Dr. B. W. Evermann, who, during the summer months, had the following assistants: Dr. J. T. Scovell, teacher of biology, Terre Haute, Ind., High School, whose time was devoted chiefly to a study of the plants of the lake and its immediate shores; Mr. Leonard Young, teacher of biology, Evansville, Ind., High School, who was put in charge of the plankton investigations; Mr. Millard Knowlton, student, Indiana State Normal School, and Mr. H. W. Clark, of Fort Wayne, Ind., general assistants, and Mr. W. F. Hill, assistant engineer, U. S. Fish Commission, who, with Prof. R. G. Gillum, teacher of physics and chemistry, Indiana State Normal School, and Mr. T. B. Evermann, student, Cornell University, made the survey for accurately mapping the lake.

This survey was completed early in September, and the volunteer assistants returned to their respective school and college duties about the first of September, leaving only Dr. Evermann and Mr. Clark to continue the investigations during the fall. When the former returned to Washington Mr. Clark remained at the lake and carried on the observations during the winter and spring.

The results of Mr. Clark's observations are important and interesting. They cover a period of the year during which but little study has been given to any American lake, and it is believed that they will add materially to a knowledge of the physics and œcology of small lakes. Perhaps the more important series of observations made during the winter pertained to the behavior of various species of fishes, mollusks, turtles, and aquatic plants, the feeding of coots and other water birds, the series of temperature records, and the action of the ice in its relation to the life in the lake and in modifying the shore line. In spring the observations regarding the breeding times, habits, and places of the different species of fishes, turtles, frogs, crustaceans, and mollusks, the growth of the aquatic plants of the lake, and the development of the plankton were of much interest and value.

The report on these investigations is now in preparation, and when published will constitute a fairly complete monograph of Lake Maxinkuckee.

BIOLOGICAL SURVEY OF THE GREAT LAKES.

This work, which had been in progress for several years, was continued under the direction of Professor Jacob Reighard, of the University of Michigan. The plan of operating a central laboratory at Put-in Bay, which should serve as the headquarters of the survey, was temporarily abandoned, and a number of independent inquiries were taken up by field parties.

One of the most important of the fundamental biological investigations which must be undertaken in lakes is the nature, abundance,

and distribution of the minute floating organisms comprehended under the general name of plankton, for it is on these that all the fishes and other large forms are ultimately dependent for their food supply. Besides the mere determination of the species of animals and plants which comprise the plankton, it is desirable to ascertain, by means of specially devised apparatus, its volume and its vertical distribution. Since 1898, Professor Reighard, in association with Prof. H. B. Ward, had been at work on a net which would register automatically the volume of water from which a given amount of plankton had been abstracted; and this subject was continued in 1900. During the summer of 1899, it had become evident that, in order to determine the amount of water passing through a plankton net when in use in the lake, it would be first necessary to "rate" in a laboratory the meter placed in the net opening for the purpose of indicating the rate of flow of the water through the opening. It was required to measure the volume of water passing through the net opening at different net velocities in a unit of time, and to determine the number of revolutions of the meter corresponding to such volume for each velocity. This could be done only in a hydraulic laboratory, and after investigation it was decided to make use of the facilities of the hydraulic laboratory of the Ohio University at Columbus, Ohio. The Commission had the services of Prof. William T. Magruder, of the Columbus laboratory, and the rating was carried out under the joint direction of Professor Magruder and Professor Ward.

The work of practically testing the efficiency of plankton nets was then transferred to Put-in Bay. Here four nets were constructed of bolting cloth of four different degrees of fineness. Each of these nets was then hauled repeatedly in the open lake from the steamer *Shearwater*, and about seven hundred such hauls were made. The automatic record of each haul showed the time occupied by the haul (recorded in fifths of a second) and the number of revolutions of the meter during the haul. From the curve constructed from the laboratory tests it was possible to determine the amount of water filtered by each net during the entire haul, as well as during each fraction of the haul. The results so far obtained may be stated as follows:

1. All of the nets experimented upon become clogged during the haul, so that they filter less water toward the end of the haul than at its beginning. This clogging is so serious as to make it doubtful whether such nets can be, in any way, made to yield quantitative results of value.

2. The records show that the pitching of the boat affects the amount of water passing through the net, a downward motion of the boat decreasing the amount and an upward movement increasing it.

3. The records show that currents in the water or the drifting of the boat noticeably increase the amount of water passing through the net.

4. It was rendered probable that the nets filter a much larger part of the water through which they are drawn than the work of Hensen has indicated.

This work yields the first direct measurement of the water passing through a plankton net, and when completed will show under what conditions, if at all, such nets may be used. The conclusions stated

above involved the careful tabulation of all the meter records, a tedious operation involving a large amount of calculating. This work was completed in December. Upon discussing the results with competent physicists and engineers it seemed best, in order to avoid all possible sources of error, to continue the work for a short time during the summer of 1901. By making slight alterations in the apparatus it is hoped to reduce to a minimum some of the unavoidable errors.

The work on the biology of the plankton algæ of Lake Erie was continued by Dr. Julia W. Snow in the botanical laboratory of the University of Michigan. Material collected at Put-in Bay was frequently forwarded to Dr. Snow in the living condition and was used in preparing cultures. The results of Dr. Snow's work during the summers of 1898, 1899, and 1900 have been embodied in a paper, with numerous colored figures, which is an important contribution to the subject.

Mr. R. H. Pond continued his investigation on the source of nutrition in the larger aquatic plants. This work was carried on chiefly at Ann Arbor by means of aquarium experiments. Mr. Pond also visited Put-in Bay at intervals and there conducted experiments in which large numbers of aquatic plants were cultivated under various conditions. Briefly stated, Mr. Pond's work shows that in the case of several species of the larger aquatic plants there is, contrary to the usual opinion, undoubted dependence on the soil for nutrition.

In April, 1901, an investigation of the breeding habits of the sturgeon in the rivers of western Michigan was undertaken by Prof. S. O. Mast, of Hope College, Holland, Mich. A study was made of the ascent of western Michigan rivers by this fish, with a view to determining where fish might be obtained for artificial propagation. Mr. Mast collected a considerable body of facts by correspondence and made some observations in person. The observations show that the sturgeon still ascends these rivers (Kalamazoo, St. Joseph, Grand, and Manistee) in small numbers, but it is not apparent that artificial propagation on a profitable scale could be undertaken there.

In May and June Professor Reighard maintained, under the auspices of the Commission, an observation camp on the Huron River, Michigan, for the purpose of studying the breeding habits of various fishes. Among the species to which special attention was given was the dogfish (*Amia calva*), which was under constant observation from the time the young fish, attended by the males, left the nests in swarms until they had attained a length of 3½ inches. The adult fish also came in for study. Other species which were studied in some detail were the common sun-fish (*Eupomotis gibbosus*), the bullhead (*Ameiurus nebulosus*), and the black bass (*Micropterus*).

The large collections of invertebrate animals of Lake Erie obtained since the beginning of the survey have been distributed as follows for study and report: Mollusks, to Mr. Bryant Walker, of Detroit; nemertine worms, to Dr. C. M. Child, of the University of Chicago; leeches and oligochætes, to Dr. J. P. Moore, of the University of Pennsylvania;

bryozoa, to Dr. C. B. Davenport, of the University of Chicago; cladocera, to Prof. E. A. Birge, of the University of Wisconsin, and flat-worms, to Mr. Raymond Pearl, of the University of Michigan.

NATURAL HISTORY OF THE CALIFORNIA SALMON.

Mr. Cloudsley Rutter, scientific assistant, has continued his studies of the salmon of the Sacramento basin. His field observations on the migrations, habits, food, diseases, etc., of the adult and young salmon have been supplemented by laboratory work addressed to the embryology, anatomy, and histology of the species. Much new information has been acquired, and additional or confirmatory data have been obtained on subjects previously considered.

Among the topics to which special attention was given, conclusive evidence has been obtained as to the essential completeness of natural spawning and of natural fertilization. It has also been shown that the death of the female salmon after spawning is not due to exhaustion incident to the spawning process, and that the fish remain on the spawning-grounds even after all the eggs are extruded and continue the spawning exertions until death. Some interesting observations were made on the diseases to which the spawning fish are subject, fungus and gill parasites being very destructive in September, but of only slight effect in November. Some additional facts in regard to the migrations of adults and fry were secured; but the rate of migration of adults is still an unsettled question and should be further investigated. It would be useful for the fish-culturists on the upper waters of the Sacramento to know definitely when to expect a run of salmon that had passed a given point in the lower river—say, Sacramento—at a certain time.

It has been appreciated that by tagging or branding much light may be thrown on the growth and movements of salmon that could not be obtained in any other way. Accordingly, tests have been made of the relative advantages of tagging fish, of marking numbers or characters on their cheeks and opercles, and of mutilating non-vital parts in various ways. Some 10,000 eggs were set aside with a view to holding the resulting fry until the fall of 1901 and liberating them after marking.

A complete study of the circulatory system of the salmon, with drawings, has been made; a full set of drawings has been prepared, showing the changes in the alimentary tract of the salmon during migration, and material has been preserved for histological study of the various organs and tissues. Series of specimens for a full embryological study have been prepared.

In the course of the work along the river a new stream was found affording special facilities for artificial propagation, especially in dry seasons, like 1900, when many of the fish fail to reach the upper courses of the river. This stream, Mill Creek, is already provided

with a dam, and in 1900 would probably have yielded three or four million eggs.

At times from July to December, 1900, Mr. F. M. Chamberlain, assistant of the Commission, was engaged in an investigation which had its origin in the continued reports of a periodic mortality among the fishes of the Sacramento River between Keswick and Redbluff, this mortality being chiefly noticeable among the salmon at the time when they were ascending that part of the river in abundance on their way to the spawning-grounds. These reports were current topics of conversation among the citizens of Redding, Anderson, and neighboring communities, and, owing to the undoubted veracity of the people who claimed to have personally noted this mortality, it became necessary for the California State Fish Commission to take the matter in hand. As this remarkable death rate had not been noticed previous to the extensive operation of the copper works at Keswick, and as those works are known to dump their waste into an affluent of the river, popular rumor at once assigned the mortality to this cause.

During the summer of 1899 Mr. N. B. Scofield, an assistant of the California Fish Commission, was detailed to make an examination of the conditions existing in the river at the affected point. He carried on a series of experiments mainly directed to the effect of the drainage from the works upon the salmon fry. The matter of the supposed injurious effect of the smelter refuse was first officially brought to the attention of the U. S. Fish Commission by the superintendent of the Baird station in 1899. As this was a matter that ordinarily comes wholly within the province of the State authorities, and affected the government only through the diminution and eventual destruction of the hatchery operations at Baird and Battle Creek in case the noticeable decrease of the salmon run was traceable to the alleged causes, no investigation was then undertaken by the U. S. Fish Commission and the matter was dropped for the time being, though verbal reports of numbers of dead salmon in the river continued from time to time to reach the station. In June of the following year, however, the testimony of reputable citizens of Redding so strongly substantiated reports of a remarkable and unnatural mortality among the salmon then ascending to their spawning-grounds, that the superintendent was impelled to again lay the matter before the Washington office, at the same time suggesting that an investigation be made. Accordingly, Mr. Chamberlain was directed to begin an examination of "the physical, chemical, and biological conditions of the various parts of the river where the fish are affected."

Personal inspection of the river in the vicinity of the copper works disclosed (1) the presence of many dead fish, not only salmon, but trout, suckers, carp, etc., either in the water or on the banks near the water line, and (2) the discharge of particles of slag and chemicals into the Sacramento from the turbid creek on which the smelter is

located. On sand bars in the creek there was found an abundant deposit of copper salts, and a preliminary test demonstrated the presence of large quantities of acid, copper, and iron in the creek water discharged into the river. It was thought advisable to take advantage of the run of adult salmon at the Baird and Battle Creek hatcheries for the purpose of conducting a series of tests as to the susceptibility of fish to the materials in the water.

Careful experiments properly controlled established the fact that copper sulphate in solution is decidedly injurious to fish life, and even in amounts as small as one part to 582,000 parts of water caused the death of salmon in a few hours. Other copper salts and free sulphuric acid, the product of mining and allied operations, were also injurious, but not so markedly as copper sulphate. The manner of death resembled that of the death of fish from simple asphyxiation from the products of their own respiration. Questions are raised as to the exact rôle of the salts in causing death (whether absorption and resulting poisoning of nerve centers, or peripheral irritation at gills and skin, or a destruction of the osmotic function of gills and consequent asphyxiation), and whether the metal or acid component of the salt is the more active agent.

Copper sulphate is produced at the ore deposits by natural causes, and leaches into the drainage of the region. This process has been in operation continuously, and is increased upon opening the deposits by the greater oxidation permitted. The extensively practiced process of roasting ores produces large quantities of copper sulphate and of sulphuric acid, both of which find their way into the drainage, which is acid in the immediate vicinity and so heavily charged with copper that efforts are made to save it by precipitation in tanks. The smelting yields the slag which is turned into the streams and which has been popularly supposed to be the chief factor in the mortality of salmon. It is comparatively unimportant, however, and the smelting process adds but little to the pollution from mining and roasting. While the small tributary which carries the drainage from the mines investigated is acid and has no fish life whatever, the Sacramento itself is mainly alkaline.

There has been for three seasons an undoubted falling off in the salmon on the hatching-grounds, while there is not apparent a corresponding diminution in the fish entering the river at its mouth.

The case against the mining and allied operations is not proven, as it does not yet appear certain that the mortality known to occur is due to artificial conditions; and if so due, that these conditions consist in the products of mining, roasting, and smelting thrown into the stream.

Mr. Chamberlain's summary of the results of his observations and experiments is as follows:

> It is well known that during the past three seasons the salmon run at the spawning-grounds has fallen off to a point where the suspension of the fish cultural work is threatened. At the same time the fishing at the entrance of the river

shows no diminution in the number of fish entering the stream. This may be due to either natural or artificial conditions.

The past few years have been a period of extreme low water in the Sacramento and its tributaries. A table, roughly taken from official records, exhibiting the estimates made at Jellys Ferry, between Redbluff and Battle Creek, shows by months the average number of cubic feet (in thousands) discharged per second:

Months.	1895.	1896.	1897.	1898.
January	----------	55	20	7
February	----------	29	40	11
March	----------	22	21	10
April	----------	25	22	8
May	28	30	14	8
June	11	15	8	8
July	8	9	6	5
August	6	7	4	4
September	6	6	4	4
October	6	6	5	5
November	7	10	6	5
December	8	20	8	6

This condition has allowed the salmon to find suitable spawning-grounds in the Sacramento before they reach the site of the hatchery operations carried on by the U. S. Fish Commission. That this cause is active, if not wholly responsible, is demonstrated by observations for the Commission made by Mr. Rutter.

The strongest support of the theory of artificial influences are the well-authenticated reports of unusual mortality among the ascending salmon. To this additional weight is given by the well-attested fact that a remarkable diminution of other fishes in the river below the entrance of Spring Creek has occurred within the last few years. The tests demonstrate that a considerable quantity of acid and copper are now finding their way into the river. The conditions for a very great augmentation of this amount exist. Both of these substances, the latter even in very minute amounts, are inimical to fish life.

It remains to be proved: (1) That numerous deaths of salmon do occur from an artificial cause within a given portion of the river. This will require resident observations. (2) That such deaths are due to either acid or metallic substances in the river. This requires complete knowledge of the strengths and combinations sufficient to induce death, and numerous and opportune samples of the river and creek water with their correct analyses. (3) That this requisite amount of these substances is due to artificial and not natural forces. This proof must come by exhibiting a greater output of the deleterious substances below the smelter than is derived from the drainage of the mines. There is nothing intrinsically impossible in any of these propositions, but owing to the peculiar conditions it has not yet been possible to establish them. The injury to salmon fry, either by destroying them by poison or by disadvantageously controlling their migration, has not been touched on; nor has the problem of the deterrent effect upon the ascending fish, causing them to seek unsuitable tributaries or to remain on the beds in the river in preference to pushing into the polluted water, received any attention.

FOOD OF CARP, BUFFALO-FISH, AND CAT-FISH.

The month of August, 1900, was spent by Mr. M. C. Marsh on the Mississippi River near Bellevue, Iowa, the Illinois River at Meredosia, Ill., the Missouri River at Omaha, Nebr., and Maumee Bay and river near Toledo, Ohio, in collecting material—chiefly stomachs and intestines—bearing on the food of the carp, the buffalo-fishes and cat-fishes. A large amount of such material was preserved and sent to Wash-

ington. This, with similar material from other waters taken at various seasons, will, when studied, be sufficient to establish the food of the carp—a question about which conflicting opinions are held—and also afford a basis for comparison of the food of other fishes with similar habits found in the same waters.

Some cursory observations on the food of carp and buffalo-fish were made incidentally to the collecting and preserving of their viscera. The season was apparently the least favorable for finding large quantities of food, but this was anticipated; and the material probably shows adequately the food for the season. The stomachs were usually empty. The food was largely microscopic and contained in what was apparently a mass of mud passed on into the intestine, where, rather than in the stomach, doubtless the digestion of such nutritive elements as the mud contained occurred. Food portions recognizable macroscopically were rarely seen. In a few cases fragments of higher water plants, such as *Ranunculus*, were found in the œsophagus and may have been taken in accidentally. The color of the small amount of fluid contents often found in the stomach indicated that green algæ had been fed upon. In the Maumee River carp fed constantly and largely upon whole wheat lost in the river a season or two previously by a grain elevator fire.

Observations carried on from Central Station in the Potomac River near Washington, D. C., during the spawning time of the shad have shown that the carp is not at all destructive to shad spawn, the carp not frequenting that part of the river bottom where the shad resort for reproduction.

Cat-fish are known to consume immense quantities of the spawn of shad and other river fishes, and, with the eel, must be reckoned among the most destructive of the natural enemies of the shad in all the streams of the Atlantic coast. A seine haul on Albemarle Sound, North Carolina, witnessed by the writer in April, strikingly exemplified the spawn-eating proclivities of the cat-fish. A large shad seine was hauled in the early evening over a ground where a school of shad had apparently just spawned. Many shad and alewives were caught, but the principal part of the catch consisted of about 5,000 cat-fish (*Ameiurus albidus*), ranging in length from 6 to 18 inches, every one of which, so far as observation went, was gorged with shad eggs.

EXAMINATION OF WEST VIRGINIA STREAMS.

The examination of the general physical and biological characters of the streams of West Virginia, and more especially the nature and abundance of the fish life, was continued in the summer of 1900 by a party in charge of Mr. W. P. Hay. Field work began at Hinton in July, and was carried on for two months, during which time numerous streams in the southwestern part of the State, tributary to the Ohio, were visited, and extensive collections of fishes and other water animals were made.

The rivers in whose basins most time was spent were the New and Greenbrier branches of the Great Kanawha, and the Guyandotte and Big Sandy, independent affluents of the Ohio. All of these are fine streams, flowing through picturesque mountain sections. The water averages slightly warmer than in the Monongahela basin; and the beds are for the most part rocky, but in places there are stretches of mud, sand, and gravel. Within very recent times the fish life of this region was extremely abundant, but is now becoming scarcer each year. The influences which are here proving inimical to the fishes are the same as those operating in the northern parts of the State, mining and lumbering. Thus the fish throughout almost the entire length of the Bluestone River have been greatly diminished by coal-mining. In some counties logging and coal-mining have together wrought the complete destruction of fish and fishing in fine streams that were formerly celebrated for their abundance of excellent fish. The employment of dynamite for fishing purposes has been common in places and has resulted in much useless destruction of fish life. The conditions in this State call for action and energetic measures on the part of the local authorities if it is intended to preserve the remaining food and game fishes.

EXPERIMENTS IN REARING LOBSTERS AND CLAMS.

The special lobster and clam investigations begun in the previous year were continued during the summer and fall of 1900, and substantial progress was made in devising methods for carrying on the cultivation of these important food animals on a large scale. The work was under the direct supervision of Dr. H. C. Bumpus, who was assisted by Dr. William C. Kendall, of the U. S. Fish Commission; Dr. A. D. Mead, of the Rhode Island Fish Commission; Prof. J. L. Kellogg, of Williams College; Mr. George H. Sherwood, Mr. J. E. Wells, and Mr. Thomas B. Gould. Experiments were conducted at Woods Hole, Gloucester, and Duxbury, Mass., at Wickford, R. I., and at several points on Casco Bay, Maine. At Wickford the Commission had the active cooperation of the Rhode Island fishery authorities and was much aided thereby. Some remarkable results were achieved in the planting of clams, and it may be said that the feasibility of private clam-culture has been established, and that the business of growing clams for market gives promise of rich pecuniary returns on many parts of the east coast. The problem of rearing lobsters in large numbers is still receiving attention, with prospect of ultimate success. In June, 1901, arrangements were being made to renew the lobster and clam experiments at several favorable points.

OYSTER-FATTENING EXPERIMENTS.

During the year the experiments in fattening oysters on artificially nourished food have been continued at Lynn Haven, Va., with more favorable results than have heretofore been attained. Each year

since the beginning of the experiments a nearer approach has been made to the end in view, namely, the perfecting of a sure means of putting poor oysters in a condition of the highest possible perfection for market, and it is now believed that the result is almost within reach of attainment. The aim has been, from the beginning, to furnish a method which would have the merit of being purely practical from a commercial standpoint, with all of the problems worked out which would confront the oyster-grower in applying it to his own purposes. During the preceding fiscal year many of the oysters introduced into the claire had become very fat, but certain irregularities were manifested which would have militated against the adoption of the process by practical men. These irregularities appeared to arise from the absence of tidal or other currents such as are necessary for the aeration of the water and the transport of the food within reach of the oyster, and at the beginning of the fiscal year certain changes were made in the plant with the object of supplying this need. A canal was constructed of sheet piling, through which currents were induced by the action of a propeller driven by a windmill erected for the purpose. To reduce the expense of handling the oysters, they were placed in the canal on shallow trays which could be raised or lowered by means of a simple type of windlass.

The construction was finished in the fall, but, certain alterations being found necessary, no oysters were introduced into the canal until February 15. They were in very poor condition, but on March 5, eighteen days later, they were reported fit for shipment. During March the results were much better, and two lots which were placed in the canal in an entirely unmerchantable condition were excessively fat at the end of eight days. Other lots fattened almost as quickly, but it was found that during many days the velocity of the wind fell below that required to move the propeller, and there was a consequent lack of circulation in the claire. It may be necessary to correct this by the use of a motor not dependent upon an uncertain power. A peculiarity in the flavor of the oysters developed in the course of the experiment, but the cause appears to be now understood, and it is thought possible to obviate it during the coming season.

SPONGE-PLANTING EXPERIMENTS.

The increasing scarcity of sponges on the Florida coast, due to the extensive fishery carried on there, induced the Commission to begin, during the present year, a series of experiments in sponge-culture. The field is not a new one, several previous experimenters having met with a measure of success, but the experiments have never reached a stage of practical utility. Sponges may be grown either from cuttings or from the egg, but the former method is so much more direct and under control that it appears to offer the more promising field for the establishment of a new industry.

In January, 1901, Dr. H. F. Moore began experiments at Sugar

Loaf Key, about 25 miles east of Key West, and at several places in Biscayne Bay. Several thousand sponge cuttings were planted at these places under a variety of environmental conditions and according to a number of different methods. The chief problem confronting the experimenter in this field is to find some ready means of attaching the cuttings to a durable support, capable of resisting the action of salt water and the ravages of the teredo and animals having similar destructive habits, and which, at the same time, will not have an injurious effect upon the growing sponge. The cuttings live and their cut surfaces heal without difficulty. About six weeks after the plants were made they were examined, and, under favorable conditions, it was found that about 95 per cent of the sheepswool cuttings were alive, healed, and apparently healthy. In several cases, where the plants were made in places exposed to very strong currents, many of the pieces were torn loose from their supports, while others had been killed by rough action of the currents. The cuttings from yellow sponges suffered a much greater mortality than those made from the sheepswool sponge, but whether this be due to the more delicate nature of the animal or to the accidental conditions under which they were planted is not yet determined. So far as has been determined the more valuable sheepswool sponge seems to be possessed of greater hardiness than its cogener. The experiments will be continued and extended during the coming season, and will have for their primary object the development of a practical method of sponge-rearing.

In the account of the operations of the steamer *Fish Hawk* will be found a reference to the work done by that vessel in beginning a survey of the sponge-grounds of Florida. As a preliminary to rational legislation for the improvement of the sponge industry, a knowledge of the extent of the grounds, their exact location, their present and past productivity, and the distribution of the commercial sponges in the different sections is indispensable. It is proposed to continue this work of the vessel, in conjunction with the sponge-planting experiments.

FISHES AND FISHERIES OF HAWAIIAN ISLANDS.

The act of Congress approved April 30, 1900, providing a government for the Territory of Hawaii, contained the following provision (section 94):

> That the Commissioner of Fish and Fisheries of the United States is empowered and required to examine into the entire subject of fisheries and the laws relating to the fishing rights in the Territory of Hawaii, and report to the President touching the same, and to recommend such changes in said laws as he shall see fit.

Early in the spring of 1901 the Commission made plans for such an inquiry as was contemplated by this act. It was decided to make the investigations comprehensive and thorough, so that the fishes and fisheries of this group of islands might be as fully understood as possible in both the biological and commercial aspects. The investi-

gations were placed under the direction of Dr. David Starr Jordan, president of Leland Stanford Junior University, and Dr. Barton W. Evermann, ichthyologist of the Commission, with the following assistants: Mr. John N. Cobb and Mr. E. L. Goldsborough, of the Fish Commission, as statistician and general assistant, respectively; Dr. Oliver P. Jenkins, of Stanford University, as volunteer scientific assistant; Mr. A. H. Baldwin and Mr. C. B. Hudson as artists.

The party sailed from San Francisco May 30 and landed at Honolulu June 5. With Honolulu as headquarters, the investigation was begun of the commercial fishes and fisheries of the island of Oahu and was well under way at the close of the fiscal year.

DISEASES OF FISHES.

During the year the study of the diseases of wild and domesticated fish has received increased attention. Mr. M. C. Marsh, the assistant who has been assigned to this branch, has devoted most of his time thereto, and for the purpose of better fitting himself for the consideration of this intricate subject, has taken special laboratory instruction in human pathology and in bacteriological methods.

Owing to the newness of the subject there is very little reliable published information on the etiology, pathology, and treatment of fish diseases, and a great deal of pioneer and preliminary work must be done in order to be in position to interpret the phenomena of disease and devise measures for its amelioration. It has already been determined that bacteria are the most potent factors in the causation of fish diseases, and the thorough study of these organisms and the perfection of cultural methods applicable to the special class of animals under consideration are of fundamental importance. As the study of fish pathology has progressed it has become more and more evident that accurate descriptions of the normal functions and structure of the various species of food-fishes are necessary, and the absence of comprehensive information of this character is strongly felt. There is scarcely one of our food-fishes which has been the subject of a systematic physiological and anatomical examination, and until this is done the interpretation of diseased conditions and the institution of remedies therefor can not be intelligently undertaken.

The diseases demanding and receiving most attention during the year were epidemics affecting the brook trout at the Manchester, Iowa, and Northville, Mich., stations of the Commission. Several weeks in July, 1900, were spent at the former station in studying a trout disease, apparently the same as that which was found at Northville in the previous year and which reappeared in the spring of 1901. The investigation of the Northville epidemic continued through June and was in progress at the close of the year.

Prof. Gary N. Calkins has recently described * a disease affecting the brook trout on Long Island, N. Y., and attributable to a newly

* Report of Commissioners of Fisheries, Game, and Forests of the State of New York for 1900.

discovered protozoan parasite (*Lymphosporidium truttæ*) to which the disease at the Commission stations bears a close resemblance in many respects. It was therefore thought that an examination of the pathological material from Northville and Manchester would probably reveal the same parasite. A careful search, however, failed to disclose it, and the evidence pointed to the original diagnosis of bacterial infection, which was confirmed in the summer of 1901. It thus appears that the brook trout is subject to both bacterial and protozoan infection, the two very similar in their external lesions.

Studies were made of various minor cases of apparent parasitism or malformation in trout and of the blisters or air blebs of the mucous membrane of trout afflicted with pop-eye. Microscopic sections of the latter showed merely the method in which the superficial layer of epithelium had been uplifted by a gas pressure beneath it, and gave evidence of no more antecedent cause. As in the case of pop-eye among fishes in the Woods Hole aquarium, no parasite appeared in the immediate neighborhood of the gas accumulation, although this does not exclude, of course, bacteria difficult of demonstration or not demonstrable by ordinary methods.

Of the other cases the most interesting was one of scarcely elevated black areas upon the skin of a brook trout, these having every appearance of parasitic cysts. On section, the black color appeared to be an increase in the normal pigment of the skin, while the elevation contained no parasites, many cocci-like bodies proving to be merely pigment granules. The slight elevation seemed to be caused by a new growth of normal tissue, and the most likely explanation is that the black spots are small neoplasms of uncertain classification. The same trout had a small polyp or projection from the skin of the belly, which upon section appeared also to partake of the nature of a tumor. Pigment was absent from it, but is also absent from that portion of the belly. There is a possible relation between this process and the black cyst-like bodies upon the sides and back of the trout.

Studies were made of the brain of salmon fry from the Pacific coast, which had died as so-called "crazy" fry, there being no external lesions or any circumstance whatever to account for the mortality. As brain pathology is of especial difficulty, and as but little is known of the microscopic features of the normal fish brain, not much was expected from this examination; but there was some evidence of brain lesions to account for the peculiar death of fry. These were not degenerations, but lack of complete development of important portions. If cases of this sort continue to arise, an important field is opened for study.

An annoying fungus attack in the Commission aquarium at the Pan-American Exposition received some attention in June. The lake water was found to be charged with fungus spores, and the quantity used was too large to admit of a filtration that would remove these spores. It was concluded that the fungus could be kept in check

only by careful attention to the individual fish as fast as they showed the slightest signs of being affected. Nothing proved to have decided advantages over the use of salt for this purpose. A permanganate of potash solution, reported as almost a specific for fungus in England, was a failure. It could not be introduced into the water continually on account of the color imparted, and especially because the fish would not endure, save for a comparatively short time, even a very weak solution. The short dip in stronger solutions was impracticable, as there was no safe margin between a strength of solution which was fatal to the fungus and harmless to the fish. Formalin was expected to give better results, but according to the report of the superintendent of the exhibit did not do so, and at best nothing would improve very much upon salt, for there remains in any case the necessity of attention to the individual. Salt is moderately successful as a remedy when the attack has not proceeded very far.

Some bacteriological work was undertaken in connection with the Lynn Haven experimental oyster claire. The so-called "muddy" taste of oysters from this claire can not be attributed to bacterial infection or pollution, although the colon bacillus was obtained from the stomach of some oysters. It was not obtained, after test for it, from the claire water or fertilizer, and its presence in the oysters is not constant. Observations are too few to show the significance of its presence in the few cases recorded.

Mr. Marsh devoted the last half of the year chiefly to work in the bacteriological and pathological laboratories of Johns Hopkins University, where an exhibit of bacteria related to fishes and fish diseases was arranged for the Commission's display at the Pan-American Exposition. Over twenty species were prepared, each represented by a plate culture and two tube cultures. They consisted of water bacteria, the pus cocci, bacteria obtained from diseased fishes, a chromogen from the disease known as "pop-eye," a phosphorescent bacillus, and the bacillus of tuberculosis in fishes. The cultures were usually killed and the medium hardened by formalin, and the tube or plate sealed with paraffin.

The necessity for carrying on microscopic and bacteriological work in the field led to the preparation of an outfit to serve as a portable laboratory. The extensive traveling outfit of the Marine-Hospital Service furnished a precedent and in a general way a model for the plans of a similar but much smaller one adapted to the needs of the Commission. It consists of the smallest quantities of apparatus and material consistent with usefulness and efficiency for performing the more ordinary bacteriological and microscopic manipulation, exclusive of incubation at body temperature and anaërobic culture. The essential idea in the gathering together of the apparatus as a unit was to do work which could be done only in the field, and which was to be continued in a more complete and permanent laboratory.

The bacteriological researches of the Fish Commission were greatly

advanced by again receiving from the Secretary of the Treasury permission to use the facilities of the Hygienic Laboratory of the Marine-Hospital Service at Washington. The director of the laboratory and his staff aided these studies by their courteous assistance in various ways.

WORK OF THE BIOLOGICAL LABORATORIES.

Woods Hole, Massachusetts (H. C. Bumpus, Director).

The administration of the work of the biological laboratory at Woods Hole was continued under the direction of Dr. H. C. Bumpus, professor of comparative anatomy in Brown University.

The opportunity to pursue studies at the laboratory was accorded to an unusually large number of biologists, whose names follow arranged under the respective institutions with which they were connected:

Brown University: George H. Sherwood, A. M.; Millett T. Thompson, A. M.; R. W. Tower, A. M.; Lee Barker Walton, A. M.; L. W. Williams, Ph. D.

Denison University: Charles Bawden; H. A. Green, B. S.; C. Judson Herrick, Ph. D.

Harvard University: Robert S. Breed, S. M.; Freeland Howe, jr., A. M.; J. M. Johnson, A. B.; J. H. McMurray; T. Ordway, A. B.; George H. Parker, Sc. D.; Herbert W. Rand, Ph. D.; M. E. Stickney, A. M.; R. M. Strong, Ph. D.; William A. Willard, Ph. D.; Robert M. Yerkes, A. M.

Indiana University: William H. Dudley, Ph. D.; C. H. Eigenmann, Ph. D.; W. J. Moenkhaus, Ph. D.

University of Iowa: W. B. Bell; H. A. Childs, B. S.

Johns Hopkins University: Caswell Grave, Ph. D.; Henry F. Perkins, A. B.

Massachusetts Institute of Technology: R. P. Bigelow, Ph. D.; George W. Field, Ph. D.; Erik H. Green, M. A.

University of Michigan: S. J. Holmes, Ph. D.; Raymond Pearl, A. B.

University of Nebraska: Albert D. Lewis, A. B.; Frank E. Watson, A. M.

Princeton University: Ulric Dahlgren, Ph. D.; C. W. F. McClure, A. M.; C. F. Silvester; G. W. P. Silvester.

Stanford University: R. P. Cowles, A. B.; Harold Heath, Ph. D.

University of Texas: Charles T. Brues; Axel L. Melander; W. M. Wheeler, Ph. D.

Washington and Jefferson College: Edwin Linton, Ph. D.; Charles W. Stone.

Williams College: James L. Kellogg, Ph. D.; Roy Spencer Richardson, Ph. M.

Miscellaneous: F. M. Chapman, American Museum of Natural History, New York; Wesley R. Coe, Ph. D., Yale University; George Ellett Coghill, M. S., University of New Mexico; Herbert H. Cushing, M. D., Woman's Medical College of Pennsylvania; Winfield A. Denny, Anderson High School, Anderson, Ind.; Charles W. Hargitt, Ph. D., Syracuse University; Charles A. Holbrook, A. B., Melrose, Mass.; Ernest Ingersoll, New York City; Porter Edward Sargent, A. M., Browne Nichols School, Cambridge, Mass.; M. W. Stickney, A. M., Worcester Academy; Francis B. Sumner, Ph. D., College of the City of New York; Ernest E. Tyzzer, A. M., Harvard Medical School; F. C. Waite, New York University Biological Station, Hamilton, Bermuda; Herbert E. Walter, A. M., North Division High School, Chicago; Charles B. Wilson, A. M., State Normal School, Westfield, Mass.

Besides the usual full equipment for the collection of all forms of marine life and their preservation and microscopic study, the laboratory had a number of accessories which contributed to the facilities. A large fish-trap, operated by the Commission in Vineyard Sound, furnished a great abundance and variety of material for study. The

steamer *Fish Hawk* and the schooner *Grampus* were attached to the station during most of the summer; the former made a number of dredging expeditions to the neighboring waters, and the latter made a successful trip to the off-lying tile-fish grounds. The steam yacht *Phalarope*, which had been purchased for this station in the previous year, proved of great assistance, and the steam launches *Blue Wing*, *Cygnet*, and *Merganser* were in general use.

The laboratory assistants were Prof. R. W. Tower, Mr. George H. Sherwood, Mr. Vinal N. Edwards, Mr. L. B. Walton, Mr. David Robinson, and Mr. H. A. Green.

The library, which had been greatly improved during the previous summer, was in constant use for reading and reference. The librarian of Brown University courteously loaned to the Commission a number of scientific periodicals and standard books of much usefulness to the laboratory workers. Biologists in all parts of the world have sent copies of their papers to the library. The accessions during 1900 numbered about 500.

Among those who conducted work in the special interest of the Commission the following may be mentioned:

Prof. C. H. Eigenmann made a study of the early life of the squeteague, one of the most abundant and important of the summer food-fishes of southern New England. His inquiries were addressed to the spawning time and grounds; the movements, habits, and food of the young; the rate of growth of the young, and the changes in their form and color incident to growth.

Prof. R. W. Tower carried on certain physical and physiological investigations regarding the air-bladder of fishes, and the chemical nature of chitin, the basis of the shells of lobsters, crabs, and other crustaceans.

Prof. Edwin Linton continued and completed his studies of the internal parasites of the fishes of the region.

Prof. W. M. Wheeler, who in the previous season had studied the free-swimming copepods of the adjacent waters, continued his consideration of this group, and began a systematic study of the pelagic copepods of the east coast. A large amount of material, which the Commission had for years been accumulating, was placed in Professor Wheeler's hands.

Prof. S. J. Holmes began the preparation of a descriptive list of the amphipods of the region.

Mr. George H. Sherwood experimented with new methods of rearing lobster fry, and, together with Mr. V. N. Edwards, made observations on the phenomena of fish migration and its relation to the physical and meteorological conditions.

Prof. J. L. Kellogg continued his experiments in clam-culture begun in the previous year.

A biological subject of more than ordinary interest to scientists and the general public is the reproduction of eels. During the summer of

1900, some observations were made at the laboratory which materially contributed to the knowledge of the spawning of eels in American waters. On July 31 the schooner *Grampus* collected a number of eel eggs at the surface, about 30 miles south of South Shoal light-ship. The eggs reached the station on August 1 and were placed in charge of Professor Eigenmann. Inasmuch as no eel eggs had before been taken in our waters, the progress of these was watched with much interest. The development was rapid, and many eggs hatched during the night of August 2–3. The last larvæ died on August 14. A preliminary note on these eggs and larvæ was published by Professor Eigenmann in Science for September 14, 1900, and a full account of his observations was prepared for publication in the Bulletin of the U. S. Fish Commission for 1901. The latter article first reviews the modern work on the development of the eel by Raffaele, Grassi, Cunningham, and other European biologists, and then describes in detail the eggs, embryos, and larvæ in hand, many drawings accompanying the text. The identification of the eggs as those of the conger eel—not previously described—is based on strong circumstantial evidence.

In the last week in August, 1900, information was received at the laboratory that for two or three weeks previous there had been streaks of reddish water in Priests Cove, Buzzards Bay, near the Fairhaven shore. It was stated that the "streaks" varied in width from 50 yards to one-half mile, and those who conveyed the information said that when fishing they had caught no fish within the limits of these areas. According to the report, thousands of dead or dying fish were seen on the shore, among them minnows, chogset, tautog, eels, etc. The tautog ranged in length from 6 inches to 1 foot, and the eels from 1 to 2 feet. There was a bad stench from the red water, and the fish washed ashore were bloated.

Upon learning of the appearance of the red water, the director of the laboratory suggested to Prof. C. H. Eigenmann and Mr. Vinal N. Edwards that they visit the region of New Bedford and examine into the matter, and this they did on August 29. Professor Eigenmann reported that reddish-brown water in a band about 100 yards wide was found extending from Fort Phoenix eastward toward Egg Island, and that the red water had been noticed during ten days previous to his visit. It appeared that the period of discoloration of the water must have culminated on August 25, for during the following night a number of dead eels, tautog, cunners, minnows, and squeteague were cast on shore, and none were cast up later. Squeteague had been abundant in the bay previous to the appearance of the red water, but none had been taken since it appeared, and fish were generally absent in its neighborhood. Some of the water placed in glass jars was found to contain great numbers of minute bodies which gave the water a yellowish tinge; many settled to the bottom, forming a yellowish flocculent layer. The bodies were found to be globular unicellular

organisms (*Peridinium*), either single or in strings of two to six, and measuring 32 to 40 μ in diameter. The red water had a density of 1.025 and a temperature of 76.75°.

It is interesting to note that this occurrence of *Peridinium* resembled that in Narragansett Bay in 1898, investigated and described by Dr. Mead (Science, vol. VIII, p. 707, 1898). The red water in Narragansett Bay was noticed during the latter part of August, September, and part of October, the maximum being reached on September 8 and 9. Fish and crustaceans tried to escape from the water, and thousands of dead fish, crabs, and shrimps were found strewn along the shores or even piled up in windrows. No fish were killed after the latter date, but the red color in the water remained, and fish were scarce in its vicinity. The water was cleared by a heavy rain, but the red color was somewhat in evidence for a time afterwards.

The following publications, based on or relating to the work of the laboratory, were issued during the fiscal year:

The gas-bubble disease of fish and its cause. By F. P. Gorham.
Some chemical changes in the developing fish egg. By P. A. Levene.
The free-swimming copepods of the Woods Hole region. By W. M. Wheeler.
Observations on the life history of the common clam, *Mya arenaria*. By James L. Kellogg.
The natural history of the starfish. By A. D. Mead.
On the movements of certain lobsters liberated at Woods Hole. By H. C. Bumpus.
Improvements in preparing fish for shipment. By R. W. Tower.
Report of a dredging expedition off the southern coast of New England, September, 1899. By Freeland Howe, jr.
Fish parasites collected at Woods Hole in 1898. By Edwin Linton.
Biological Notes No. 1.
The chemical composition of the subdermal connective tissue of the ocean sun-fish. By Erik H. Green.
The hydroids of the Woods Hole region. By C. C. Nutting.
Parasites of fishes in the Woods Hole region. By Edwin Linton.

Beaufort, North Carolina (H. V. Wilson, Director).

The Beaufort laboratory, which had opened on June 1, 1900, was closed on September 10. It was reopened on May 1, 1901, and was in operation at the close of the fiscal year. The laboratory occupied the same temporary quarters as in previous years, and Dr. H. V. Wilson, professor of biology in the University of North Carolina, continued in charge. The steam launch *Petrel* and several small boats were attached to the station during the summer.

Those who availed themselves of the facilities of the station were as follows:

Johns Hopkins University: Dr. Caswell Grave, Mr. R. P. Cowles, Mr. J. A. E. Eyster, Mr. O. C. Glaser, Mr. D. H. Tennent.
Columbia University: Dr. H. E. Crampton, Mr. H. B. Torrey, Mr. J. C. Torrey, Dr. E. B. Wilson.
University of North Carolina: Dr. H. V. Wilson, Mr. J. W. Tarrentine.
University of Missouri: Dr. W. C. Curtiss.
University of Alabama: Dr. John Y. Graham.
Bryn Mawr College: Dr. T. H. Morgan.
Trinity College (N. C.): Dr. J. I. Hamaker.
Goldsboro (N. C.) Schools: Mr. R. E. Coker, principal.

The following accounts of some of the investigations here carried on are extracted from Dr. Wilson's report:

Mr. Coker and Mr. Tarrentine, who during June had made a study of the food of certain edible fish, spent the greater part of July in studying the life-history of a small nonedible fish, one of the blennies very common about wharf piles, where sheepshead feed. The eggs of this fish are deposited in layers, adhering to old barnacle shells, ascidians, or rocks. The eggs were hatched in the laboratory. The striking characteristics of egg, old embryo, and just-hatched larva were worked out in sufficient detail to permit recognition of these stages wherever met. The notes on this investigation, together with those on the food study, will be handed in as soon as certain figures are completed. Mr. Coker spent the remaining part of the summer in studying the life-history of a small goose barnacle parasitic on the gills of two edible crabs, the blue crab and stone crab. About 70 per cent of the blue crabs are infested. The parasite is sometimes so abundant in individual crabs as to fill the gill chamber, the number running up to about 1,000. Certain simple experiments indicate that the parasite unquestionably weakens the crab. The systematic points of the form were carefully worked out. The form differs from previously described species of this interesting genus, and must be recorded as a new species.

Dr. Grave devoted most of his time to his economic investigation of the conditions favorable to oyster-culture. Constant watch was kept upon an experimental oyster bed, which included many small areas planted at different times from April to August, 1900, inclusive, on some of which steamed shells were scattered broadcast; on others similar shells were laid down in rows; on still others, steamed and fresh shells were hung on wires. The catch of spat was abundant on all areas, there being no difference between steamed and fresh shells, contrary to the opinion and practice of local oystermen; but where shells were planted in rows there is a much better catch of spat than where they are scattered broadcast. In this locality the breeding season of the oyster extends from March to December, inclusive. The spat deposited on the bed has grown well. Many of the oysters on June 1, 1901, measured about 2½ inches in length, others only 1 to 1½ inches; larger oysters, 3 inches long, were occasionally taken.

Dr. Grave also continued his investigations upon the feeding of oysters, both on natural beds and beds composed of planted adults, and upon the physical factors affecting the growth of oysters. His study of the influence of shore line, bottom, and current on the shape taken by natural beds, an account of which has already been published in the Johns Hopkins University Circular (April, 1901) bears upon the shape and direction which should be given to planted beds in the North Carolina sounds.

During the summer Dr. Grave collected material and data for a proposed report upon the Beaufort echinoderms from the systematic

and natural-history points of view. He has now complete accounts of the life histories of the southern sand-dollar and the most abundant of the Beaufort ophiurans. His signal success in rearing these forms from the unfertilized egg to the adult condition has been due to his employment of a particular method of feeding. Muddy sand, rich in diatoms, is dredged, and is kept in proper light, in laboratory aquaria, until the number of diatoms has vastly increased. Such diatomaceous sand is used as stock food. A supply of it is added to each aquarium jar in which the larvæ are kept; the water in the jar is not changed, and the jar is kept covered.

Dr. Hamaker carried on observations on the natural history of the Beaufort actinians, studying their characteristic features in the living state, both in their natural habitat and when kept in the laboratory aquaria. Their variability and individual color changes make this study from life essential to a successful systematic treatment. Notes were made on the breeding, food, etc. Material was prepared for careful histological work, and the study of this material was continued during the year.

Mr. H. B. Torrey studied the early development of an annelid (*Axiothea*), one of the most abundant worms on the sand shoals. Mr. Torrey's attention was concentrated upon the "cell lineage," or the origin of particular layers and organs from particular segments of the egg. Incidentally observations on the general natural history were made. The eggs are laid in jelly masses, very frequently at any rate, in the early morning. The eggs emerge from the mouth of the burrow already fertilized. The larva is an opaque modified trochophore, free-swimming in the jelly. It emerges from the jelly in from two to twelve days, and then has a structure adapted for bottom life. *Axiothea* is a common article of food for several bottom-feeding fish (hog-fish, croaker, sea mullet).

Dr. E. B. Wilson and Dr. Crampton made studies of the early development of the eggs of the various invertebrates. The former gave special attention to the development of the unfertilized eggs of the white sea-urchin, which are made to develop parthenogenically under the stimulus of magnesium chloride. Dr. Crampton studied the behavior of the eggs of the oyster and other mollusks when submitted to unusual chemical and physical conditions.

BIOLOGICAL LABORATORY ON THE GULF OF MEXICO.

For a number of years the establishment of a biological laboratory on the Gulf coast of the United States has been under consideration and has been urged by members of Congress and private citizens of the Gulf States. During the Fifty-sixth Congress unusual attention was given the matter and a number of bills providing for the station were introduced. In order to put the Commission in possession of full information regarding the available sites, it was determined to have the entire Gulf seaboard canvassed in advance of any action

Congress might see fit to take. Accordingly, during the fall and winter of 1900–1901 Dr. H. F. Moore was detailed to visit Texas and Louisiana for this purpose; Dr. W. C. Kendall went to all suitable localities on the shores of Mississippi and Alabama, and Dr. H. M. Smith made an examination of points on the Florida coast between Tarpon Springs and Key West. Reports on these investigations have been submitted.

SCIENTIFIC INQUIRY EXHIBIT AT PAN-AMERICAN EXPOSITION.

An exhibit illustrating the functions and work of this division, and forming a part of the general exhibition of the Commission at the Pan-American Exposition, was collated by Dr. H. F. Moore, Mr. M. C. Marsh, and the writer.

The collection, which was one of the most complete and instructive of the kind ever brought together by the Commission, included the following objects: (1) Models of the steamers *Albatross* and *Fish Hawk*, to whose investigations most of the knowledge of the deep-water life of our coasts is due; (2) samples of the beam trawls, dredges, rakes, tow nets, tangles, seines, gill nets, and other apparatus used in making collections of water animals; (3) samples of the vessels used for the preservation and transportation of collections; (4) a sounding machine and its accessories, for determining the depth of water, the bottom temperature, and the nature of the bottom; (5) a map showing where the Commission has carried on scientific investigations, and plates used in illustrating the reports of the Commission.

As pertinent to the functions of this division of the Commission, there were also shown series of specimens illustrating the aquatic resources of the country, including the economic mollusks, crustaceans, and other invertebrates of the United States and Porto Rico. Special exhibits of this nature were the commercial sponges of Florida; the pearl-bearing mussels of the Mississippi basin, many of which are used in button-making; the oysters of all coastal regions, displayed with reference to their growth, life-history, and enemies. Ten charts showing the geographical distribution of the most important food-fishes of the Great Lakes were also prepared.

INTERNATIONAL CONGRESS OF AQUICULTURE AND FISHERIES.

In conjunction with the Universal Exposition at Paris in 1900, there was held, under the direction of the French government, an international congress of aquiculture and fisheries, under the presidency of Prof. Edmond Perrier, member of the Institute and director of the Museum of Natural History of Paris. The congress convened on September 14, in the Palais des Congrés, and was formally opened by the French minister of commerce. Professor Perrier then delivered an able introductory address, and the congress resolved itself into sections for convenience in considering the various subjects that came before it. About 100 delegates from Europe and America were in attendance, most of the countries of Europe being represented by

persons distinguished in the lines of fish-culture, the commercial fisheries, or biological science. The United States Fish Commission was officially represented by Dr. H. M. Smith. Other members from the United States were Dr. T. H. Bean, director of forestry and fisheries on the staff of the United States Commission to the Paris Exposition, and Lieut. Commander A. C. Baker, U. S. N.

Papers and discussions covering a wide range of topics were presented in the sections and the general séances. The subjects considered came under the heads of scientific studies of the salt and fresh waters, the methods of the sea fisheries, marine fishing considered as sport, practical aquiculture and fishing in fresh waters, oyster-culture and mussel-culture, the utilization of fishery products, and the social and hygienic relations of the fishermen. Dr. Fabre-Domergue, the inspector-general of marine fisheries, gave an illustrated lecture on "The character and limitations of man's influence on the productivity of the seas." The proceedings of the congress included visits to the fishery palace of the exposition and to the museum of natural history, and a number of social features, concluding with a banquet on September 19 at the Palais D'Orsay, given by the French minister of marine.

Before adjourning the congress took action on a number of resolutions and propositions that had been brought up in the course of the meeting. Among the numerous formal views expressed, the following have special application or interest to the United States:

(1) Investigations of lacustral biology are important for both their scientific interests and practical value, especially as they bear upon fish-culture, and should everywhere be encouraged as far as possible.

(2) In small and unimportant streams line fishing only should be permitted, the use of nets or other apparatus being limited as much as possible.

(3) The introduction of exotic species of fishes into international streams and lakes, or the planting of the eel in waters still free from the species, should be undertaken only after obtaining the sanction of all States interested.

(4) The success attending shad-culture in the United States and the important economic results therefrom indicate that similar operations in this country (France) would be apt to prove of substantial benefit.

(5) Each government should be urged to take the most effective measures for facilitating the free movements of migrating fishes (especially salmon) in ascending streams, to foster the study of improved systems for the passage of fish, and to provide for fishways in all industrial and agricultural dams having a greater height than 0.80 meter. Water-tight dams should not be built with a vertical face downstream, but with both surfaces sloping at an angle of about 30°.

(6) The governments should promote the study of means of detecting poisoned fishes, just as in human criminology, and all poisoned animals should be seized and the holders thereof prosecuted so as to put an end to this nefarious practice.

(7) As to the pollution of streams by various factories, it is declared to be the duty of the manufacturers to devise the means necessary to the purification of the waste products of their works, while the part of the government consists in seeing that the water be turned back to the rivers in a condition not injurious to useful plant and animal life.

(8) Where previous permission is necessary for the locating of industrial works upon streams, this permission should be granted only after the deposit by those

interested and the study by competent experts of specimens of waste analogous to that which would be discharged by the projected factory.

(9) Maritime nations should, as soon as possible, reach an international agreement for the regulation of lights on fishing vessels.

(10) The powers should close to navigation, by restrictive laws promulgated by each government, certain defined zones resorted to by marine fishermen.

(11) The governments represented at the congress should encourage by bounties the destruction of injurious marine animals, such as sharks and porpoises, and should also promote investigations leading to the utilization of such animals.

(12) The various governments should encourage experiments in freezing fish, with the following purposes in view: (*a*) The benefit of marine fishermen by the safe and regular marketing of a commodity which naturally is eminently perishable. (*b*) Securing a more uniform price for fish. (*c*) Supplying laboring people with a cheap article of food.

(13) The different governments should encourage the construction of steam vessels designed for the collection of fishing products at sea in order to insure the better utilization of such products.

(14) In order to facilitate the introduction of fishing products into regions where at present they are but little used, railroad companies should adopt uniform freight rates and should expedite the transportation of these products as much as possible.

(15) The governments should provide subsidies to promote the study of the best methods of preparing fish upon the fishing-grounds, and the packing of fresh fish in a manner to secure their transportation in the best possible condition.

(16) New fishing schools should be established which would extend maritime instruction and give to the pupils practical experience at sea. Special courses should be founded for instructing men and women in the preparation and utilization of sea products. Diplomas should be granted to marine fishermen who pursue the course of study at these schools, and who can pass a creditable examination before a competent commission.

(17) Earnest efforts should be made in fishing ports to instruct marine fishermen in the care of their health on board as well as on shore. The necessity for this has been pointed out by previous congresses.

(18) The fishing industry and marine fishermen should be considered as neutral in time of war.

(19) The congress directs the formation of a permanent international committee to have charge of the organization of future fishery congresses, such committee to be selected by joint action of officers of the congress together with the official delegates of the different powers and of the learned societies here represented.

(20) The next international congress of aquiculture and fisheries shall be held in 1902, in St. Petersburg.

(21) The congress orders the periodical publication of international comparative fishery statistics on the basis of The Hague Statistical Congress of 1869, including full statistics of accidents on fishing vessels. This publication shall be intrusted to a permanent international committee or, in default of this, to the St. Petersburg committee of organization.

(22) Recognizing the importance of having an organ of international fishery congresses, the proposition of the Russian Society of Fisheries and Fish Culture is accepted, and the Revue International de Pêche et de Pisciculture is designated as such organ.

EUROPEAN BIOLOGICAL STATIONS.

The writer's presence in Europe, in connection with the International Congress of Aquiculture and Fisheries, afforded an opportunity to visit some of the great biological stations, for the purpose of making observations on their management, construction, equipment, and methods of study. The time available permitted the visiting of only

two such stations, but these were the foremost in Europe, namely, the Marine Biological Laboratory at Plymouth, England, and the Zoological Station at Naples, Italy.

Marine Biological Laboratory, Plymouth.—The laboratory occupies a bluff 110 feet above Plymouth Harbor, and affords a strikingly fine view of this historic roadstead, with Eddystone light-house in the distance. The building, which, with its equipment, cost about £12,000, is constructed of gray sandstone, and consists of a two-story central part with two square three-story wings or towers. The lower floor contains an aquarium, the second floor is occupied by the main laboratory and rooms opening therein, and the upper story is devoted to a library, general rooms, etc. Water for the laboratory and aquarium is pumped from the harbor into large cement-lined pools under the building, holding about 100,000 gallons, thence to tanks with capacity for 5,000 gallons at the top of the building, whence it is led by gravity. The vessels and boats belonging to the station are a 7-ton steamer, a 40-ton barge, and two small sailboats.

The laboratory is under the control of the Marine Biological Association of the United Kingdom, of which Prof. E. Ray Lankester is president, and is supported by annual subsidies from the government and the Fishmongers' Company, of London, by annual subscriptions, by fees of investigators, by paid admissions to the aquarium, and by the sale of specimens and publications. The resources of the institution in 1899 were about £2,000. The director receives an annual salary of £200.

The accommodations are rather limited, there being only ten tables for investigators. Those entitled to the privileges of the laboratory are the nominees of the founders of the institution and of the persons who have endowed tables. There are no restrictions as to the subjects which may be studied. The laboratory fees of investigators are 30s. a week, which amount covers all materials and supplies except the more costly reagents. No sleeping or eating accommodations are afforded by the laboratory except to the director, who has an office and private rooms in the building. The laboratory is open throughout the year, but is occupied mostly in summer and during the Easter and Christmas holidays.

The aquarium is small, but attractive, and devoted to the marine species of the vicinity. The general public is admitted from 10 to 6 o'clock daily on payment of an entrance fee of 6d., which is reduced to 2d. on Wednesdays. The disease known as "pop-eye," which is observed in aquarium fish in America, is quite prevalent here.

The Journal of the Marine Biological Association, a quarterly, is the official organ of the laboratory.

The Naples Zoological Station.—This institution, the largest and most noted of its kind, is situated in a spacious park near the shore of the beautiful Bay of Naples. Investigators here have the advantage of climate that is perpetually mild, physical surroundings of great

beauty and interest, a rich historical environment, and a liberal and efficient management, combined with a fauna of the adjacent waters which is extremely rich and varied. Although but little farther south than Woods Hole, the fauna is much more subtropical.

Dr. Anton Dohrn, the accomplished founder and director of the Naples station, together with his assistants, Dr. Lo Bianco and Dr. Meyer, very courteously entertained the visitor. The station occupies a large white stone quadrangular structure, with an aquarium on the ground floor and offices, laboratories, workrooms, and library on the upper floors. To establish the station in 1872 required $100,000, to which considerable sums have been added for permanent improvements and new construction.

The station has a large income, although not in excess of its needs. It is supported by government grants, by the endowment of the tables, by fees for admission to the aquarium, and by the sale of specimens. The most liberal patrons of the institution are Germany and Italy. The German government gives an annual fund of 40,000 marks ($10,000), without any restrictions as to its use. The Italian government gives yearly 5,000 francs ($1,000) for the maintenance of the library. The principal source of income is the endowment of tables, of which 34 were supported in 1900, as follows: Various German provinces, 11 tables; Italian government, 9 tables; Russian government, 2 tables; Austrian government, 2 tables; Hungarian, Swiss, Dutch, and Belgian governments, 1 table each; in England, the University of Oxford, the University of Cambridge, and the British Association for the Advancement of Science, 1 table each; in the United States, the Smithsonian Institution, the Association of American Women, and Columbia University, 1 table each. To endow a table costs $500 per annum, so that the income of the station from this source is $17,000. During each season from 50 to 60 workers from all parts of the civilized world carry on investigations here. Those occupying tables are without any restrictions as to the lines of work they pursue and the publication of results; and, besides being provided with the animals for study, they are supplied with microscope, reagents, individual aquaria, and all other things needful for their work.

Another enterprise which adds $3,000 to $5,000 annually to the resources of the institution is the sale to naturalists and museums of preserved specimens of marine animals for study and exhibition. The reputation of the Naples station for such material is universally recognized, and its output reaches all parts of the world.*

The regular employees of the station number 45. By a provision of the German government a pension fund is established for superannuated employees. There is also a reserve fund maintained to meet extraordinary conditions. Two small steam vessels, one decked and one open, are used in conjunction with the laboratory.

---

* *See* Methods Employed at the Naples Station for the Preservation of Marine Animals, by Dr. Salvatore Lo Bianco. Translated by E. O. Hovey. Bull. U. S. Nat. Mus., No. 39, Part M

The periodical publications of the station are Contributions from the Naples Zoological Station, Fauna and Flora of the Gulf of Naples, and The Zoological Yearbook.

Although this is primarily a station for biological research, an important feature is the aquarium, which is justly celebrated for the beauty of its installation and the healthy condition of the exhibited animals. The aquarium is one of the leading attractions of Naples and is much resorted to by visitors and by the local population. The price of admission to the aquarium is 2 francs, except on Sunday afternoons, when it is 1 franc, and on special occasions, when it is half a franc. The income from this source is about $8,000 annually.

The grotto arrangement of the aquarium is unconventional, and the general impression made on the visitor is novel and pleasing. The 26 large tanks with large glass fronts are skillfully lighted from above, no light reaching the aquarium room except that which comes through the water. As one stands before the tanks and sees the groups of healthy, contented fishes and invertebrates, with nothing neglected that contributes to the naturalness of their environment, one easily fancies he is at home with the animals on the sea bottom.

The salt water required for the aquarium (and laboratory) is retained in large subterranean reservoirs; it is supplied through a closed circulation and is renewed only as needed to replace losses due to evaporation and leakage. Owing to the care exercised in feeding the animals and to the "balance" which has been established, it is rarely necessary to cleanse the aquarium tanks. The water reaches the aquaria from a nozzle with a contracted aperture about a foot above the surface, and the jet carries considerable air with it; this form of aeration is regarded as quite essential for the health of the animals and renders a direct air circulation unnecessary. The water supplying each series or line of tanks runs from one to another by means of a surface gate and discharges into the reservoirs under the building, so that there is a current in each tank, which is considered quite necessary.

Seaside laboratory at Concarneau, France.—Mention should be made of a visit to the laboratory at Concarneau, France—one of the many small seaside laboratories and biological schools maintained by the French marine department. At this institution, in the center of the great sardine fisheries of Brittany, some important biological and fish-cultural work is being done under the direction of Dr. Eugéne Biétrix. An interesting adjunct of this station is a rectangular stone pound or inclosure (*vivier*) constructed many years ago by M. Guillou, for the experimental rearing of lobsters. The pound is very extensive, with eight compartments in which the tide flows; is built of granite and schist, and cost 130,000 francs. It was the first of the kind in France, and is still used in part for the same purpose as lobster pounds are on the coast of Maine. In view of the attention now given to lobster-rearing in the United States, and the

comparatively recent date at which lobster-culture was taken up in this country, it is worthy of note that as early as 1859 M. Guillou, in conjunction with M. Coste, began his successful lobster-rearing experiments. The writer was privileged to examine the collection of artificially-reared lobsters (ranging from the newly-hatched larvæ to examples 10 years old) for which the French government made an award.

MISCELLANEOUS FOREIGN INQUIRIES.

While in Europe the writer investigated a number of fisheries and fishery industries, primarily with a view to possible improvements in similar industries in the United States. The fisheries to which special attention was given were the herring, the sardine, and the lobster. A number of other subjects had been assigned for investigation, but the time available did not permit their consideration.

Immense quantities of the sea herring are imported into the United States annually from England, Scotland, Holland, and Norway, and meet with a ready sale at prices that are uniformly higher than those commanded by the same fish prepared in the same manner on our own coasts. The Commission was in receipt of communications from fishermen, fish-packers, and wholesale dealers in the Eastern States, asking that it investigate the methods of the herring trade in Europe and determine the factors which give to the foreign herring their superiority over the native-prepared fish.

Visits were made to the most important herring centers of England, Scotland, and Holland; and through the courteous assistance of government fishery officials and United States consular officers, much valuable information was obtained. Acknowledgments for assistance are due especially to Mr. Charles E. Fryer, of London, one of the government inspectors of fisheries for England and Wales; Mr. James R. Nutman, of Great Yarmouth; Mr. W. F. Robertson, of Edinburgh, secretary of the Fishery Board for Scotland; Mr. James Ingram, of Aberdeen, one of the Scotch fishery inspectors; Col. S. Listoe, United States consul at Rotterdam, and Mr. E. A. Man, United States consular agent at Schiedam. The observations on the herring fishery of the countries named will be incorporated in a special report now in preparation.

In view of the large consumption of imported sardines in the United States and the relatively high prices commanded by them, the sardine fishery of France and the canning industry dependent thereon were made the subject of a special investigation for the purpose of determining the factors which underlie the general superiority of the French sardines over the native "sardines" prepared from the young of the sea herring. The French sardine industry centers in the province of Brittany, in which one of the most important fishing and canning towns is Concarneau. In this place some time was devoted to a study of the natural history of the sardine, the fishing methods and

appliances, and the canning processes. The manner of preparing cod roe as bait for use in the sardine fishery was fully considered, as a remunerative trade can doubtless be developed in this commodity between the United States and France. These inquiries were greatly facilitated by Mr. Emile Deyrolle-Guillou, to whom special acknowledgments are due for numerous courtesies. A special report on the French sardine industry has been submitted, and will shortly be issued. Some attention was also given to the sardine (i. e., pilchard) fishery in Cornwall, England, and the limited canning of sardines at Mevagissey in that county.

The downward tendency of the United States lobster fishery and the special investigations addressed to the lobster which the Commission has been conducting for several years, made it quite desirable that the actual condition of the lobster fisheries of other countries should be determined, together with the measures which have been adopted abroad for protecting the lobster and promoting the fishery. Accordingly, at various places in England, Scotland, and France, visited in connection with the foregoing inquiries, data on this subject were obtained by personal inspection, and information in regard to several other countries was secured from government officials and others met at the fishery congress at Paris. The history of the lobster fisheries of the different European countries is of decided importance for comparison with that of our own lobster industry.

One current feature of the lobster fisheries of England and France—the most important in Europe—is of special interest as showing the interrelation of aquatic animals and man's possible influence thereon. Owing, in part at least, to the active fishery for the conger eel, this fish has become comparatively uncommon in lobster-fishing regions, where it was formerly very abundant. This is especially the case on the southern coast of England and west coast of France. At the same time these coasts have been visited by enormous numbers of octopus, which have proved very disastrous to the lobster fishery, reducing the number of lobsters on the fishing-grounds and also entering the fishermen's traps and destroying the lobsters after they have been caught, so that in some important districts the lobster fishery has been rendered a total failure. The conger eel is perhaps the most potent natural enemy of the octopus, and according to a widespread and apparently well-founded belief it is to the scarcity of this fish that the present unprecedented scarcity of lobsters is to be attributed.

Another industry to which some attention was given, looking to an extension of the fishery in the United States, was the gathering of seaweed in France. This is one of the leading water products of that country, the value of these marine vegetables taken annually on the west and south coasts being upward of $1,000,000. In the United States, with a vastly longer coast line and a much greater abundance of useful algæ, the yearly production is insignificant.

REPORT OF THE DIVISION OF STATISTICS AND METHODS OF THE FISHERIES.

By C. H. Townsend, *Assistant in Charge.*

The work in which the statistical field agents of this division were employed during the past fiscal year included investigations of the fisheries of the Pacific coast, the Great Lakes, and the Mississippi River and tributaries.

The Pacific coast region was canvassed by Mr. W. A. Wilcox, with the assistance in California of Messrs. A. B. Alexander and E. A. Tulian, the latter having been transferred temporarily to duty in this division. Mr. T. M. Cogswell canvassed Lake Superior, Messrs. C. H. Stevenson and E. S. King Lake Michigan, and Mr. W. A. Roberts Lakes Huron and St. Clair and the St. Clair and Detroit rivers.

Mr. J. B. Wilson collected information on the wholesale fishery trade of Lake Erie, the statistics of the general fisheries of that lake and of Lake Ontario having been obtained before the commencement of the fiscal year by Mr. J. N. Cobb.

The inquiries respecting the Mississippi River and tributaries were conducted as follows:

Mr. Cobb canvassed the Ohio River and the Mississippi and tributaries from Alton, Ill., to New Orleans, being assisted in Arkansas and Louisiana by Mr. G. H. H. Moore.

Mr. Roberts canvassed the Mississippi above Dubuque, Iowa; Mr. Stevenson the Mississippi from Dubuque to Keokuk, Iowa, and the Missouri and its tributaries; Mr. King the Illinois River and tributaries and the Mississippi between Keokuk, Iowa, and Alton, Ill. Inquiries respecting the Tennessee River were made by Mr. Wilson.

The minor investigations during the year included canvasses of the Lake of the Woods by Mr. Cogswell, the fisheries of Nevada by Mr. Tulian, the sponge and sturgeon fisheries of Florida and portions of the interior waters of Texas by Mr. Cobb. Later Mr. Cobb was detailed to assist in an investigation of the fisheries of the Hawaiian Islands.

Mr. Stevenson was detailed for one month for field work in connection with the preparation of reports on the utilization of fishery products.

Other investigations relating to the lobster, sturgeon, menhaden, and salmon fisheries of the Atlantic coast were in progress at the close of the fiscal year, Messrs. Wilcox, Cogswell, Moore, and Wilson being in the field.

Mr. Barton A. Bean was employed for a short time in May and June in making inquiries respecting shad fisheries of the Susquehanna River in Dauphin and Lancaster counties, Pa.

During the summer, Mr. Townsend, assistant in charge, visited the Pribilof Islands for the purpose of ascertaining the condition of the fur-seal herd and the sealing industry located there.

Capt. S. J. Martin and Mr. F. F. Dimick, local statistical agents of the division stationed at Gloucester and Boston, Mass., have submitted monthly reports on the quantity and value of certain fishery products landed at those ports by American vessels.

The following single-sheet bulletins, containing advance statistics in condensed form, have been issued during the year:

No. 17. Fisheries of the Great Lakes, 1899.
No. 18. Statement of the quantity and values of certain fishery products landed at Boston and Gloucester, Mass., by American fishing vessels during the year 1899.
No. 19. Sponge fishery of Florida, 1900.
No. 20. Fisheries of the Pacific coast, 1899.
No. 107. Fisheries of the Mississippi River and tributaries, 1899.

Additional bulletins showing the quantity and values of certain fishery products landed at Boston and Gloucester by American fishing vessels have been issued monthly as usual.

The publications appearing during the year which emanated from this division were: "Statistics of the fisheries of the New England States," and "Statistics of the fisheries of the Middle Atlantic States." A paper on the sturgeon fishery of the Delaware River and Bay, and one on the lobster fishery of Maine, were prepared by John N. Cobb.

FISHERIES OF BOSTON AND GLOUCESTER.

The important fisheries of these ports are reported upon monthly by local agents of the Commission. The total quantity of products landed by American vessels was 162,218,921 pounds, worth $4,385,102. The returns for 1900, as compared with those of the previous year, show a decrease of 14,555,380 pounds and an increase in value of $191,450. The total number of fares was 7,513.

At Boston there has been an increase in the quantity and value of products as compared with 1899, which is shown chiefly in the supply derived from banks off the New England coast. There has been a slight increase in the quantity and value of fresh fish, while the quantity and value of salt fish has been more than doubled. The total quantity of products landed at Boston was 66,820,912 pounds, valued at $1,598,506. The number of fares was 3,731, of which 203 were from the eastern banks and 3,528 from grounds off the New England coast. The fresh and salted fish from the eastern banks amounted to 9,786,500 pounds, valued at $281,546, and from grounds off the New England coast, 57,034,412 pounds, valued at $1,316,960.

There were 95,398,009 pounds of fish landed at Gloucester, valued

at $2,786,596, a decrease from the previous year of 16,651,563 pounds, with an increase in value of $21,290. There has been a decrease in the quantity and value of fresh fish and an increase in the quantity and value of salted fish. The fares landed at Gloucester numbered 3,782, of which 668 were from the eastern banks and 3,114 from grounds off the New England coast. The total of fish from the eastern banks was 55,596,243 pounds, valued at $1,427,697, and from grounds off the New England coast 39,831,766 pounds, valued at $1,358,899.

Summary, by fishing-grounds, of certain fishery products landed at Boston, Mass., in 1900 by American fishing vessels.

Fishing-grounds.	No. of trips.	Cod, fresh.		Cod, salted.		Cusk, fresh.		Haddock, fresh.	
		Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:									
La Have Bank	57	885,600	$19,987	.....	.....	147,500	$2,055	959,000	$20,129
Western Bank	56	938,300	21,416	.....	.....	73,500	959	355,500	9,015
Quereau Bank	12	266,000	7,218	.....	.....	4,000	120	.....	.....
St. Peters Bank	1	60,000	1,200	.....	.....	.....	.....	.....	.....
Off Newfoundland	33	2,000	60	.....	.....	.....	.....	.....	.....
Cape Shore	44	591,200	13,086	61,000	$750	73,000	1,171	477,500	14,368
Total	203	2,743,100	62,967	61,000	750	298,000	4,305	1,792,000	43,512
West of 66° W. longitude:									
Browns Bank	40	512,000	10,308	.....	.....	67,000	1,118	784,000	16,335
Georges Bank	440	2,472,500	60,803	.....	.....	89,000	1,457	8,577,700	150,852
Cashes Bank	49	270,800	8,198	.....	.....	142,500	1,880	227,600	7,523
Clark Bank	6	32,000	551	.....	.....	3,000	60	86,000	1,948
Fippenies Bank	8	33,000	1,070	.....	.....	6,800	96	52,500	1,715
Middle Bank	412	682,600	16,913	.....	.....	15,500	179	1,874,000	41,469
Jeffreys Ledge	173	347,200	10,467	.....	.....	53,000	833	795,500	18,262
South Channel	571	4,826,700	107,390	20,000	350	152,200	2,196	7,860,500	173,736
Nantucket Shoals	97	1,245,000	21,123	.....	.....	.....	.....	223,700	3,586
Off Highland Light	87	210,100	5,685	.....	.....	3,000	28	717,200	20,353
Off Chatham	83	337,800	7,556	.....	.....	9,000	175	1,047,300	23,148
Shore, general	1,562	4,004,850	84,384	50,000	750	77,800	935	4,197,850	86,666
Total	3,528	14,974,550	334,448	70,000	1,100	618,800	8,957	26,443,850	545,593
Grand total	3,731	17,717,650	397,415	131,000	1,850	916,800	13,262	28,235,850	589,105

Fishing-grounds.	Hake, fresh.		Pollock, fresh.		Halibut, fresh.		Halibut, salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:								
La Have Bank	121,500	$1,994	21,000	$320	48,800	$4,570	.....	.....
Western Bank	123,000	1,537	6,000	110	584,800	37,835	.....	.....
Quereau Bank	3,000	112	.....	.....	189,000	17,460	.....	.....
St. Peters Bank	.....	.....	.....	.....	15,000	1,800	.....	.....
Off Newfoundland	.....	.....	1,000	15	611,000	28,880	180,000	$9,900
Cape Shore	92,000	1,101	20,400	278	15,900	903	.....	.....
Total	339,500	4,744	48,400	723	1,464,500	91,448	180,000	9,900
West of 66° W. longitude:								
Browns Bank	29,500	450	13,500	170	16,600	1,626	.....	.....
Georges Bank	303,700	5,055	32,600	292	55,350	5,421	.....	.....
Cashes Bank	382,300	7,929	22,800	381	2,700	280	.....	.....
Clark Bank	45,000	665	1,000	13	.....	.....	.....	.....
Fippenies Bank	57,000	825	2,000	25	.....	.....	.....	.....
Middle Bank	526,000	6,759	29,600	412	250	25	.....	.....
Jeffreys Ledge	620,800	8,904	166,300	2,153	400	51	.....	.....
South Channel	3,272,000	42,046	270,500	2,544	41,250	5,178	.....	.....
Nantucket Shoals	24,000	293	69,500	603	1,000	150	.....	.....
Off Highland Light	157,300	2,582	13,000	92	.....	.....	.....	.....
Off Chatham	148,900	2,610	58,000	524	1,100	124	.....	.....
Shore, general	1,011,100	15,257	446,300	5,364	5,000	485	.....	.....
Total	6,577,600	93,375	1,125,100	12,573	123,650	13,340	.....	.....
Grand total	6,917,100	98,119	1,173,500	13,296	1,588,150	104,788	180,000	9,900

Fishery products landed at Boston—Continued.

Fishing-grounds.	Mackerel, fresh.		Mackerel, salted.		Other fish, fresh.		Other fish, salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:								
La Have Bank					1,606	$122		
Quereau Bank					600	60		
Off Newfoundland					1,410,000	40,100	1,441,800	$22,555
Cape Shore			6,000	$360				
Total			6,000	360	1,412,200	40,282	1,441,800	22,555
West of 66° W. longitude:								
Georges Bank	329,775	$17,980	382,600	20,605	1,043,800	73,008		
Middle Bank	1,643,775	46,031	194,400	2,593	23,000	1,408		
Jeffreys Ledge					400	24		
South Channel	65,000	2,600	141,600	7,084	8,950	691		
Nantucket Shoals					3,600	288		
Off Highland Light					1,400	182		
Shore, general	1,980,812	88,933	679,700	38,020	586,050	7,967	16,000	160
Total	4,019,362	155,544	1,398,300	68,302	1,667,200	83,568	16,000	160
Grand total	4,019,362	155,544	1,404,300	68,662	3,079,400	123,850	1,457,800	22,715

Fishing-grounds.	Total fresh.		Total salted.		Grand total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:						
La Have Bank	2,185,000	$49,177			2,185,000	$49,177
Western Bank	2,081,100	70,872			2,081,100	70,872
Quereau Bank	462,600	24,970			462,600	24,970
St. Peters Bank	75,000	3,000			75,000	3,000
Off Newfoundland	2,024,000	69,055	1,621,800	$32,455	3,645,800	101,510
Cape Shore	1,270,000	30,907	67,000	1,110	1,337,000	32,017
Total	8,097,700	247,981	1,688,800	33,565	9,786,500	281,546
West of 66° W. longitude:						
Browns Bank	1,422,600	30,007			1,422,600	30,007
Georges Bank	12,904,425	314,868	382,600	20,605	13,287,025	335,473
Cashes Bank	1,048,700	26,191			1,048,700	26,191
Clark Bank	167,000	3,237			167,000	3,237
Fippenies Bank	151,300	3,731			151,300	3,731
Middle Bank	4,794,725	113,196	194,400	2,593	4,989,125	115,789
Jeffreys Ledge	1,983,600	40,694			1,983,600	40,694
South Channel	16,497,100	336,381	161,600	7,434	16,658,700	343,815
Nantucket Shoals	1,566,800	26,043			1,566,800	26,043
Off Highland Light	1,102,000	28,922			1,102,000	28,922
Off Chatham	1,602,100	34,137			1,602,100	34,137
Shore, general	12,309,762	289,991	745,700	38,930	13,055,462	328,921
Total	55,550,112	1,247,398	1,484,300	69,562	57,034,412	1,316,960
Grand total	63,647,812	1,495,379	3,173,100	103,127	66,820,912	1,598,506

Summary, by fishing-grounds, of certain fishery products landed at Gloucester, Mass., in 1900 by American fishing vessels.

Fishing-grounds.	No. of trips.	Cod, fresh.		Cod, salted.		Cusk, fresh.		Cusk, salted.	
		Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:									
La Have Bank	142	3,446,785	$58,607	646,869	$21,021	369,485	$3,941	59,000	$708
Western Bank	170	8,409,580	142,832	5,246,570	129,024	152,000	1,816	4,000	90
Quereau Bank	95	296,380	5,392	2,078,153	55,334				
Green Bank	5			46,865	1,523				
Grand Bank	88	336,000	9,763	15,650,270	336,941				
St. Peters Bank	3	51,000	998	10,000	350	3,000	35		
Bacalieu Bank	57			12,000	330				
Off Newfoundland	85			169,305	4,910				
Cape North	1			110,000	2,550				
Cape Shore	19	95,000	1,628	38,000	950	10,000	115	2,000	45
Gulf of St. Lawrence	3			4,000	120				
Total	668	12,634,745	219,220	24,012,032	553,053	534,485	5,907	65,000	843

Fishery products landed at Gloucester—Continued.

Fishing-grounds.	No. of trips.	Cod, fresh.		Cod, salted.		Cusk, fresh.		Cusk, salted.	
		Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
West of 66° W. longitude:									
Browns Bank	28	341,780	$7,219	155,300	$3,477	55,685	$669		
Georges Bank	405	955,700	18,414	5,281,229	156,336	32,500	414	58,000	$1,325
Cashes Bank	30	478,300	6,990			288,300	3,341		
Middle Bank	56	1,436	29						
Jeffreys Ledge	80	18,500	370						
Ipswich Bay	19	179,000	2,375						
South Channel	12	119,060	3,292			22,820	307		
Nantucket Shoals	2			67,120	1,576				
Bay of Fundy	54	196,625	2,845	8,000	220	135,640	1,561	8,000	180
Shore, general	2,428	1,408,596	32,494	314,140	7,704	31,670	335		
Total	3,114	3,698,997	74,028	5,825,789	169,313	566,615	6,627	66,000	1,505
Grand total	3,782	16,333,742	293,248	29,837,821	722,366	1,101,100	12,534	131,000	2,348

Fishing-grounds.	Haddock, fresh.		Haddock, salted.		Hake, fresh.		Hake, salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:								
La Have Bank	1,241,330	$19,724			1,606,401	$14,499		
Western Bank	168,630	2,543	6,000	$75	434,000	3,860	6,000	$75
Cape Shore	75,000	1,050			15,000	120	14,000	210
Total	1,484,960	23,317	6,000	75	2,055,401	18,479	20,000	285
West of 66° W. longitude:								
Browns Bank	396,065	6,460			35,945	488		
Georges Bank	2,410,500	31,016			48,500	553		
Cashes Bank	48,340	845			783,870	6,668		
Jeffreys Ledge					55,000	550		
Ipswich Bay	7,135	43						
South Channel	84,620	2,618			65,720	890		
Bay of Fundy	4,000	24			953,000	8,067	58,000	783
Shore, general	371,032	7,129			531,020	6,135		
Total	3,321,692	48,135			2,473,055	23,351	58,000	783
Grand total	4,806,652	71,452	6,000	75	4,528,456	41,830	78,000	1,068

Fishing-grounds.	Pollock, fresh.		Pollock, salted.		Halibut, fresh.		Halibut, salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:								
La Have Bank	15,120	$96			37,914	$3,024		
Western Bank	10,600	64	5,000	$63	98,653	6,470		
Quereau Bank			24,180	302	1,386,581	120,246		
Green Bank					151,175	14,087		
Grand Bank					632,910	47,170	18,915	$1,016
St. Peters Bank					25,004	2,034		
Bacalieu Bank					1,883,972	100,199	1,361,220	77,123
Off Newfoundland					1,138,264	50,244	3,200	160
Cape Shore					2,000	160		
Gulf of St. Lawrence					3,000	240	6,000	300
Total	25,720	160	29,180	365	5,359,473	343,874	1,389,335	78,599
West of 66° W. longitude:								
Browns Bank	2,000	12						
Georges Bank			11,890	149	323,807	27,482		
Cashes Bank					1,000	60		
Middle Bank	1,604	10						
Jeffreys Ledge	927,150	5,736						
Bay of Fundy	8,600	52			2,225	200		
Shore, general	3,139,250	22,987						
Total	4,078,604	28,797	11,890	149	327,032	27,742		
Grand total	4,104,324	28,957	41,070	514	5,686,505	371,616	1,389,335	78,599

Fishery products landed at Gloucester—Continued.

Fishing-grounds.	Mackerel, fresh.		Mackerel, salted.		Other fish, fresh.		Other fish, salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:								
Western Bank					732	$37		
Quereau Bank					1,640	177		
Off Newfoundland					1,819,300	61,246	5,559,200	$89,167
Cape Shore	1,440	$56	468,200	$30,243				
Gulf of St. Lawrence			9,400	494			120,000	2,100
Total	1,440	56	477,600	30,737	1,821,672	61,460	5,679,200	91,267
West of 66° W. longitude:								
Georges Bank	132,480	5,231	5,422,600	276,251	160	8		
Middle Bank	122,400	6,606	115,400	4,938				
Ipswich Bay	1,800	90	19,600	1,078			40,000	400
Bay of Fundy			1,806,400	84,859	80,000	2,400		
Shore, general	4,611,812	222,425	6,719,600	371,218	203,040	1,577	98,800	1,388
Total	4,868,492	234,352	14,083,600	738,344	283,200	3,985	138,800	1,788
Grand total	4,869,932	234,408	14,561,200	769,081	2,104,872	65,445	5,818,000	93,055

Fishing-grounds.	Total fresh.		Total salted.		Grand total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
East of 66° W. longitude:						
La Have Bank	6,717,035	$99,891	705,869	$21,729	7,422,904	$121,620
Western Bank	9,274,195	157,622	5,267,570	129,327	14,541,765	286,949
Quereau Bank	1,684,601	125,815	2,102,333	55,636	3,786,934	181,451
Green Bank	151,175	14,087	46,865	1,523	198,040	15,610
Grand Bank	968,910	56,933	15,669,185	337,957	16,638,095	394,890
St. Peters Bank	79,004	3,067	10,000	350	89,004	3,417
Bacalieu Bank	1,883,972	100,199	1,373,220	77,453	3,257,192	177,652
Off Newfoundland	2,957,564	111,490	5,731,705	94,237	8,689,269	205,727
Cape North			110,000	2,550	110,000	2,550
Cape Shore	198,440	3,129	522,200	31,448	720,640	34,577
Gulf of St. Lawrence	3,000	240	139,400	3,014	142,400	3,254
Total	23,917,896	672,473	31,678,347	755,224	55,596,243	1,427,697
West of 66° W. longitude:						
Browns Bank	831,475	14,848	155,300	3,477	986,775	18,325
Georges Bank	3,903,647	83,118	10,773,719	434,061	14,677,366	517,179
Cashes Bank	1,599,810	17,904			1,599,810	17,904
Middle Bank	125,440	6,645	115,400	4,938	240,840	11,583
Jeffreys Ledge	1,000,650	6,656			1,000,650	6,656
Ipswich Bay	187,935	2,508	59,600	1,478	247,535	3,986
South Channel	292,220	7,107			292,220	7,107
Nantucket Shoals			67,120	1,576	67,120	1,576
Bay of Fundy	13,380,090	15,149	1,880,400	86,042	3,260,490	101,191
Shore, general	10,296,420	293,082	7,132,540	380,310	17,428,960	673,392
Total	19,617,687	447,017	20,184,079	911,882	39,801,766	1,358,899
Grand total	43,535,583	1,119,490	51,862,426	1,667,106	95,398,009	2,786,596

Statement, by months, of quantities and values of certain fishery products landed at Boston and Gloucester by American fishing vessels during the year 1900.

Months.	No. of trips.	Cod, fresh.		Cod, salted.		Cusk, fresh.		Cusk, salted.	
		Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
January	242	865,900	$25,256			71,000	$1,167		
February	276	635,600	25,431			62,000	1,658		
March	423	2,026,600	45,072			43,000	871		
April	423	1,083,100	28,994			84,000	956		
May	300	1,736,400	25,035	61,000	$750	110,000	1,031		
June	241	1,467,600	25,816	50,000	750	71,600	830		
July	327	1,913,800	31,696	20,000	350	5,200	77		
August	331	1,697,500	35,839			24,000	315		
September	270	1,591,100	39,953			39,500	649		
October	325	1,435,000	49,737			111,000	1,426		
November	297	781,600	25,462			114,500	1,790		
December	276	1,583,450	39,124			181,000	2,492		
Total at Boston	3,731	17,717,650	397,415	131,000	1,850	916,800	13,262		
January	159	520,780	13,394	113,000	3,579	66,500	864		
February	255	324,627	12,368	76,360	2,576	14,000	177		
March	270	1,274,599	23,090	323,745	10,780	21,000	264		
April	316	1,968,057	22,949	916,529	20,524	73,920	850		
May	303	1,697,482	23,147	2,199,940	57,150	254,120	2,923	4,000	$90
June	377	1,184,604	16,210	4,114,285	94,807	386,645	4,008		
July	349	1,068,702	17,033	7,510,122	144,431	122,500	1,468	87,000	1,358
August	354	1,531,230	24,826	2,866,183	66,389	62,000	778	40,000	900
September	321	1,539,188	26,099	2,605,215	68,341	24,000	301		
October	474	1,382,806	27,153	3,040,186	86,666	12,500	154		
November	360	2,728,101	62,905	5,225,205	138,539	10,000	132		
December	244	1,113,566	24,074	847,051	28,584	53,915	615		
Total at Gloucester	3,782	16,333,742	293,248	29,837,821	722,366	1,101,100	12,534	131,000	2,348
Grand total	7,513	34,051,392	690,663	29,968,821	724,216	2,017,900	25,796	131,000	2,348
Landed at Boston in 1899	3,866	19,684,550	437,756	50,000	1,250	1,102,800	13,353		
Landed at Gloucester in 1899	3,954	28,609,038	506,574	36,855,649	1,022,516	2,308,749	30,285	227,987	5,185

Months.	Haddock, fresh.		Haddock, salted.		Hake, fresh.		Hake, salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
January	2,052,400	$48,660			318,500	$7,289		
February	3,252,500	84,751			227,600	7,275		
March	6,483,000	92,180			127,600	3,916		
April	2,991,700	40,136			132,800	1,586		
May	1,799,900	33,437			316,800	2,934		
June	1,581,900	33,552			381,300	3,901		
July	2,211,400	25,966			368,000	3,553		
August	1,738,700	37,892			424,500	5,095		
September	1,847,800	44,492			836,800	8,223		
October	1,533,600	52,571			1,445,800	18,538		
November	1,047,300	42,023			1,304,700	19,657		
December	1,695,650	53,445			1,032,700	16,152		
Total at Boston	28,235,850	589,105			6,917,100	98,119		
January	721,466	15,107			113,325	1,657		
February	680,117	11,872			12,465	180		
March	1,914,021	23,100			5,270	95		
April	622,362	4,339			68,060	544		
May	127,548	845	4,000	$50	435,921	3,491	2,000	$25
June	49,373	1,188			1,026,728	8,548		
July	28,000	168			1,309,585	11,798	72,000	993
August	40,400	305	2,000	25	306,050	2,760	4,000	50
September	24,000	144			600,715	5,256		
October	32,500	465			353,180	3,390		
November	133,435	3,439			103,281	1,806		
December	433,430	10,480			193,876	2,325		
Total at Gloucester	4,806,652	71,452	6,000	75	4,528,456	41,830	78,000	1,068
Grand total	33,042,502	660,557	6,000	75	11,445,556	139,949	78,000	1,068
Landed at Boston in 1899	25,145,160	554,198			8,489,800	99,708		
Landed at Gloucester in 1899	8,146,208	119,003	15,279	187	8,166,804	78,608	53,500	807

Statement of quantities and values of certain fishery products, etc.—Continued.

Months.	Pollock, fresh.		Pollock, salted.		Halibut, fresh.		Halibut, salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
January	14,000	$209			71,350	$5,552		
February	14,100	412			69,050	5,986		
March	30,590	770			103,200	9,560		
April	19,900	224			117,000	6,321		
May	48,500	356			332,400	14,630		
June	38,900	412			167,800	11,499		
July	231,100	1,475			250,550	13,780		
August	112,400	883			118,200	6,251		
September	111,000	1,625			145,850	10,887	180,000	$9,900
October	258,200	3,171			91,300	9,162		
November	210,500	2,580			97,300	8,550		
December	84,400	1,179			24,150	2,610		
Total at Boston	1,173,500	13,296			1,588,150	104,788	180,000	9,900
January	3,718	35			402,687	33,685		
February	1,186	11			241,554	17,192		
March	4,398	26			353,638	30,517		
April	1,600	10			409,157	27,001		
May	4,166	25			1,075,541	46,455	2,000	100
June	8,901	54			673,562	38,491		
July	9,728	69	11,890	$149	653,831	35,943	52,035	2,602
August	13,870	89			634,349	31,279	340,500	18,550
September	109,810	695	5,000	63	389,879	28,872	881,600	50,417
October	2,141,748	13,647			368,886	37,588	113,200	6,930
November	1,448,507	11,149	24,180	302	309,607	26,629		
December	356,692	3,147			173,814	17,964		
Total at Gloucester	4,104,324	28,957	41,070	514	5,686,505	371,616	1,389,335	78,599
Grand total	5,277,824	42,253	41,070	514	7,274,655	476,404	1,569,335	88,499
Landed at Boston in 1899	1,286,850	12,883			1,606,585	112,462		
Landed at Gloucester in 1899	6,056,252	41,147	144,000	1,799	6,629,807	428,329	788,790	59,218

Months.	Mackerel, fresh.		Mackerel, salted.		[1] Other fish, fresh.		[1] Other fish, salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
January					290,000	$8,700		
February					510,000	14,600	186,000	$3,510
March					460,000	13,800	83,800	1,905
April					150,000	3,000		
May	8,340	$276						
June	447,522	14,800	227,400	$11,425				
July	725,275	41,959	369,600	20,297	565,450	35,450		
August	2,106,525	58,274	631,000	24,913	450,100	33,395		
September	510,775	27,818	112,800	6,924	148,950	8,170		
October	220,925	12,417	63,500	5,103	237,150	3,022		
November					245,050	3,409	548,000	7,960
December					22,700	304	640,000	9,350
Total at Boston	4,019,362	155,544	1,404,300	68,662	3,079,400	123,850	1,457,800	22,715
January					498,000	16,193	49,000	771
February					860,000	30,100	535,800	9,577
March					230,000	7,650	30,000	525
April					170,000	4,250	14,000	245
May			18,200	1,092				
June	3,632,840	189,842	2,485,400	116,653			120,000	2,100
July	153,792	8,921	4,060,400	214,665				
August	701,250	19,857	4,664,600	233,191	892	45		
September	187,200	6,443	2,519,400	139,652			13,000	228
October	194,580	9,320	707,800	56,289	204,680	1,754	85,800	1,160
November	270	25	105,400	7,539			3,735,000	58,125
December					141,300	5,453	1,235,400	20,324
Total at Gloucester	4,869,932	234,408	14,561,200	769,081	2,104,872	65,445	5,818,000	93,055
Grand total	8,889,294	389,952	15,965,500	837,743	5,184,272	189,295	7,275,800	115,770
Landed at Boston in 1899	798,752	43,905	196,400	14,695	5,335,832	123,866	1,028,000	14,270
Landed at Gloucester in 1899	430,788	27,373	3,665,800	275,570	3,475,921	75,609	6,475,000	93,096

[1] Includes herring from Newfoundland, 3,229,000 pounds frozen, $101,346; and 7,001,000 pounds salted, $111,722.

Statement of quantities and values of certain fishery products, etc.—Continued.

Months.	Total fresh.		Total salted.		Grand total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
January	3,683,150	$96,833			3,683,150	$96,833
February	4,770,850	140,113	186,000	$3,500	4,956,850	143,614
March	9,273,900	166,169	83,800	1,905	9,357,700	168,074
April	5,478,500	81,217			5,478,500	81,217
May	4,352,340	77,699	61,000	750	4,413,340	78,449
June	4,156,622	90,810	277,400	12,175	4,434,022	102,985
July	6,270,775	153,956	389,600	20,647	6,660,375	174,603
August	6,671,925	177,944	631,000	24,913	7,302,925	202,857
September	5,231,775	141,817	292,800	16,824	5,524,575	158,641
October	5,332,975	150,044	63,500	5,103	5,396,475	155,147
November	3,800,950	103,471	548,000	7,960	4,348,950	111,431
December	4,624,050	115,306	640,000	9,350	5,264,050	124,656
Total at Boston	63,647,812	1,495,379	3,173,160	103,127	66,820,912	1,598,506
January	2,326,476	80,935	162,000	4,350	2,488,476	85,285
February	2,133,949	71,900	612,160	12,153	2,746,109	84,053
March	3,802,926	84,742	353,745	11,305	4,156,671	96,047
April	3,313,156	59,943	930,529	20,769	4,243,685	80,712
May	3,594,778	76,886	2,230,140	58,507	5,824,918	135,393
June	6,962,653	258,341	6,719,685	213,560	13,682,338	471,901
July	3,346,138	75,400	11,793,447	364,198	15,139,585	439,598
August	3,290,041	79,939	7,917,283	319,105	11,207,324	399,044
September	2,874,792	67,790	6,024,215	258,701	8,899,007	326,491
October	4,690,880	93,471	3,946,986	151,045	8,637,866	244,516
November	4,733,201	106,085	9,089,785	204,505	13,822,986	310,590
December	2,466,593	64,058	2,082,451	48,908	4,549,044	112,966
Total at Gloucester	43,535,583	1,119,490	51,862,426	1,667,106	95,398,009	2,786,596
Grand total	107,183,395	2,614,869	55,035,526	1,770,233	162,218,921	4,385,102
Landed at Boston in 1899	63,450,329	1,398,131	1,274,400	30,215	64,724,729	1,428,346
Landed at Gloucester in 1899	63,823,567	1,306,928	48,226,005	1,458,378	112,049,572	2,765,306

THE MACKEREL FISHERY.

The mackerel fishery has been of unusual interest during the seasons of 1900 and 1901 on account of its improved condition as compared with other recent years. The present period of scarcity began with the year 1886, when the catch of salted mackerel landed from the vessels fell from 329,943 barrels in 1885 to 79,998 barrels in 1886, and has never since risen to 100,000 barrels annually. According to information received from Mr. F. F. Dimick, the local agent of the Commission at Boston, the New England catch of salted mackerel in 1900 was 87,967 barrels. This, with the exception of 1888, when it was 88,382 barrels, was larger than at any time since 1885, and gave rise to the hope on the part of the fishermen and dealers that the fishery might in the near future regain its former importance. The present season, 1901, has so far been less encouraging. The quantity of salted mackerel landed by the New England fleet to the 1st of September was 57,072 barrels, valued at $627,792, and for the same period in 1900 it was 67,533 barrels, valued at $742,863. The contrast between present and former conditions will be better appreciated when it is stated that in 1884, which was one of the most prosperous years in the history of the fishery, 214,189 barrels of salted mackerel were landed by the 1st of September, and the total catch for the season was 478,076 barrels.

The greater part of the fresh mackerel caught along the coast is shipped to Boston, and it is usually estimated that the receipts at that port cover about 90 per cent of the whole New England catch. The receipts of domestic fresh mackerel to the 1st of September, 1901, are reported to be 44,196 barrels, valued at $265,176, while for the same period in 1900 the quantity landed was only 40,553 barrels, but the value was $273,732. There has therefore been an increase in the quantity so far during the season and a decrease in the value. It is generally believed that the total catch of fresh and salted mackerel will not be equal to that of last year, and some of the fishermen have discontinued mackerel fishing to engage in other branches of fishery which seem to be more promising. However, some good catches are being reported, and it is not impossible that conditions may improve. The southern mackerel catch for this season, 1901, amounted to 16,419 barrels, valued at $180,609, which is more than 5,000 barrels larger than it was in either of the five preceding years.

SHAD IN PENNSYLVANIA.

An inquiry in Dauphin and Lancaster counties, Pennsylvania, shows that since the destruction of the dam at Columbia some years ago there has been considerable improvement in the shad fisheries of the Susquehanna River above that point. The catch at four different localities in the above-named counties in 1900 aggregated 16,840 shad, or about 67,360 pounds, having a value of $3,990.

GERMAN CARP IN LAKE ERIE.

An interesting fact in connection with the fishing industry of this lake is the increased utilization of the German carp. This fish, now abundant in nearly all waters where it has been introduced, has become commercially important in a number of regions. For several years it has constituted more than half of the total yield of the fisheries of the Illinois River. An investigation of the fisheries of the Mississippi River and tributaries for 1899 shows the catch of German carp to have been 11,869,840 pounds, valued at $289,258. While taken in our interior waters in abundance by anglers and used locally, the growth of the carp fishery as an industry has been slow. In a former report of this division attention was called to the importance of this fishery in the Illinois River, and the development of a good market for the catch in certain eastern cities, where the proportion of foreigners in the population is large.

In Lake Erie German carp are very abundant, and in the effort to utilize them new markets are being found in the Mississippi Valley, an important part of the catch being sent to St. Louis, Louisville, Cincinnati, and other cities. When taken in larger quantities than required, they can be easily retained in ponds until wanted. The writer recently visited a pond near Port Clinton, Ohio, where about 50 tons of German carp were held. Fishermen in th' ; region usually receive 1½ cents a pound, sometimes 2 cents. When extra large quan-

tities are taken the surplus is frequently sold for the manufacture of fish fertilizer. German carp sent to New York and other eastern cities are shipped round, but if destined for other markets they are generally dressed. Most of the catch is made with seines.

Recent inquiries respecting commercial fishing carried on in Utah show that the catch of German carp in Utah Lake and tributaries in 1900 amounted to 344,685 pounds, or about three times the quantity taken from the same waters in 1895. More than half of the catch in this lake was made with spears.

FISHERIES OF LAKE OF THE WOODS.

A canvass of the fisheries of Lake of the Woods, made for 1899, shows a continued decrease of the fisheries in nearly all respects. The number of persons engaged was 126, and the amount of capital employed was $58,830, a decrease of 47 persons and $49,272 since 1894. The total yield of the fisheries was 626,225 pounds, valued at $32,815, while in 1894 it was 2,198,984 pounds, valued at $56,747. The fisheries of this lake are prosecuted chiefly for the sturgeon. Since 1894 the catch of this species has decreased from 1,059,267 pounds, worth $31,778, to 197,033 pounds, having a value of $16,623.

The number of pound nets, the principal form of apparatus of capture, has decreased from 148 in 1894 to 58 in 1899.

Other products of these fisheries have decreased in similar proportions. The shrinkage in value has not been so great as in quantity for the reason that as the supply has diminished prices have advanced. The three following tables show the extent of the fisheries of this lake for the year 1899, a fourth table presenting a comparison of the yield of the various species taken in pound nets for a term of years:

Table showing the number of persons employed in the fisheries of Lake of the Woods for the year 1899.

How employed.	No.
On vessels transporting	12
In shore fisheries	100
On shore, in fish-houses, etc	14
Total	126

Table showing the apparatus and capital employed in the fisheries of Lake of the Woods for the year 1899.

Items.	No.	Value.
Vessels transporting	4	$18,000
Tonnage	113	
Outfit		2,225
Boats	35	1,480
Pile-drivers	12	1,450
Barges	4	2,500
Apparatus of capture:		
Pound nets	58	15,425
Fyke nets	25	250
Shore property		17,500
Total		58,830

Table showing, by apparatus and species, the yield of the fisheries of Lake of the Woods for the year 1899.

Apparatus and species.	Lbs.	Value.
Pound nets:		
Buffalo	6,013	$113
Pike	39,903	1,200
Pike perch (wall eyed)	124,722	6,236
Sturgeon*	197,033	16,623
Trout	423	17
White-fish	179,242	6,722
Total	547,336	30,911
Fyke nets:		
Bullheads	78,889	1,904
Grand total	626,225	32,815

*Included with sturgeon are 18,941 pounds of caviar, valued at $11,365, and 391 pounds of sturgeon sounds, valued at $332.

Table showing the pound-net catch in the American waters of Lake of the Woods in certain years.

Species.	1894.	1897.	1898.	1899.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
Buffalo	80,620	16,965	28,130	6,013
Pike	231,474	48,275	56,676	39,903
Pike perch (wall-eyed)	405,104	137,461	92,181	124,722
Sturgeon	1,059,267	511,159	330,601	197,033
Trout	11,501	650	440	423
White-fish	411,018	71,907	112,624	179,242
Total	2,198,984	786,417	620,652	547,336

FISHERIES OF THE GREAT LAKES.

A statistical canvass of the fisheries of the Great Lakes for 1899—the results of which have already been published in condensed form as statistical bulletin No. 17—shows the total yield and value of fishery products to be nearly equal to that of 1890, the largest on record. In 1899 the fisheries of the Great Lakes yielded 113,728,040 pounds, valued at $2,611,482.

The total number of persons engaged in the fisheries was 9,670, and the capital invested amounted to $6,617,716. The vessels employed numbered 208, having a value, with their outfits, of $802,621. The number of boats employed was 3,281, worth $277,766. The apparatus of capture which represented the greatest value was gill nets, valued at $690,518. Pound nets and trap nets were valued at $660,408. The number of gill nets in use was 105,687, and of pound and trap nets 3,837.

The most important species among the products of the fisheries with respect to value was herring, worth $941,067. The catch of trout was valued at $431,276, and of white-fish at $297,023. The yield of pike and pike perch was valued at $325,941.

The various lakes as compared with each other differ considerably in the value of their fisheries. Lake Erie, the fisheries of which are

much more extensive than those of any of the other lakes, yielded products valued at $1,150,895; Lake Michigan, $876,743; Lake Huron, $308,078; Lake Superior, $150,862; Lake Ontario, $101,040; Lake St. Clair, St. Clair and Detroit rivers, $23,864.

The following tables show the persons, apparatus, and capital employed in the fisheries of the Great Lakes in 1899, and the quantity and value of the fishery products:

Fisheries of the Great Lakes, 1899.

Items.	Lake Superior.		Lake Michigan.		Lake Huron.		Lake St. Clair, St. Clair and Detroit rivers.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons employed	613		3,255		1,241		442	
Vessels and outfits	10	$51,604	80	$254,905	12	$55,045		
Tonnage	277		1,321		256			
Boats [1]	305	27,245	1,098	67,968	527	40,835	188	$3,770
Seines	1	50	11	510	9	673	13	1,255
Gill nets	7,229	99,283	49,857	288,395	5,676	54,384	60	600
Pound nets and trap nets	162	25,820	805	186,349	996	111,839	5	1,050
Fyke nets	15	150	1,477	23,627	398	7,632		
Lines		588		3,158		346		644
Other apparatus		320		2,500		210		271
Shore and accessory property		111,023		869,629		148,489		26,945
Cash capital		56,000		1,218,200		55,500		20,000
Total investment		372,083		2,915,241		474,953		54,535
PRODUCTS.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass			8,565	$644	5,659	$396	200	$14
Bluefins	435,060	$11,317	498,318	12,794				
Bullheads	7,600	304	53,452	1,367	141,429	4,255	1,200	18
Carp, German			25,280	492	6,369	143	8,600	221
Cat-fish			8,710	315	432,977	12,372	16,305	611
Eels			484	40	861	49		
Herring, fresh [2]	886,018	6,954	10,225,653	211,784	1,073,957	10,696		
Herring, salted [2]	239,460	4,816	11,348,063	212,245	2,625,850	49,722		
Ling or lawyers			122,339	886	20,880	167		
Menominee, fresh			375,053	9,747	112,417	2,667		
Menominee, salted			144,030	4,560	24,060	810		
Perch	3,879	39	3,077,741	57,972	2,740,669	32,690	40,000	1,202
Pike	15,602	316	87,316	4,490	191,751	6,995	42,365	1,795
Pike perch (wall-eyed pike) [4]	13,679	495	173,733	7,555	1,110,516	49,294	268,350	11,877
Rock bass	934	28	4,161	43	83,344	1,612	3,700	217
Sheepshead			55,372	722	160,646	1,009	17,050	131
Sturgeon [3]	4,415	176	108,279	7,187	30,497	1,268	7,600	1,352
Suckers, fresh	5,447	57	934,642	10,143	980,695	18,502	33,600	325
Suckers, salted	6,200	114	109,136	1,931	126,795	1,818		
Sun-fish					61,062	739	250	4
Trout, fresh	2,664,838	85,572	5,407,110	241,015	1,879,411	80,077	69,915	2,884
Trout, salted	453,331	15,127	81,837	3,666	7,690	346		
White bass			4,380	146				
White-fish, fresh	647,670	23,710	1,407,142	68,025	584,168	31,525	69,902	3,087
White-fish, salted	45,521	1,837	103,222	5,467	8,140	385		
Other fish			117	9	484	21	630	126
Crawfish			135,861	3,498				
Frogs					8,000	520		
Total	5,429,654	150,862	34,499,996	876,743	12,418,327	308,078	579,067	23,864

[1] Includes steam tugs and gasoline launches under 5 tons.
[2] Includes "long-jaws" and "chubs."
[3] Sturgeon includes 47,470 pounds of caviar, valued at $30,510, apportioned as follows: Michigan, 5,044 pounds, $2,264; Huron, 300 pounds, $195; Lake St. Clair, St. Clair and Detroit rivers, 960 pounds, $768; Erie, 32,365 pounds, $21,122; Ontario, 8,801 pounds, $6,161.
[4] Pike perch (*Stizostedion vitreum*) is also called blue pike and wall-eyed pike.

Fisheries of the Great Lakes, 1899—Continued.

Items.	Lake Erie.		Lake Ontario.		Total for Great Lakes.	
	No.	Value.	No.	Value.	No.	Value.
Persons employed	3,728		391		9,670	
Vessels and outfits	104	$439,977	2	$1,090	208	$802,621
Tonnage	1,665		22		3,541	
Boats	876	79,466	287	8,482	3,281	227,766
Seines	104	8,390	24	420	162	11,298
Gill nets	41,678	229,182	1,187	18,674	105,687	690,518
Pound nets and trap nets	1,724	329,500	145	5,850	3,837	660,408
Fyke nets	617	15,750	451	5,412	2,958	52,571
Lines		3,470		1,355		9,561
Other apparatus		142		427		3,870
Shore and accessory property		1,050,977		18,440		2,225,503
Cash capital		563,700		20,200		1,933,600
Total investment		2,720,554		80,350		6,617,716
PRODUCTS.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	133,746	$9,866	48,046	$3,133	196,216	$14,053
Bluefins					933,378	24,111
Bullheads			511,042	18,600	714,723	24,544
Carp, German	3,633,697	51,456	1,000	50	3,674,346	52,362
Cat-fish	1,002,704	30,451	7,381	234	1,468,077	43,983
Crappie	60,000	1,800			60,000	1,800
Eels	849	61	123,840	6,163	126,034	6,313
Herring, fresh	33,427,797	431,037	61,178	2,789	45,674,603	673,260
Herring, salted			25,600	1,024	14,238,973	267,807
Ling or lawyers					143,219	1,053
Menominee, fresh					487,470	12,414
Menominee, salted					168,090	5,370
Mooneye	43,836	867			43,836	867
Perch	3,315,496	52,625	407,017	11,822	9,584,802	156,350
Pike	19,625	1,241	100,365	5,861	457,024	20,698
Pike perch (blue pike)	4,544,786	139,301	186,996	9,439	4,731,782	148,740
Pike perch (wall-eyed pike)	1,735,174	86,455	10,440	827	3,311,892	156,503
Rock bass	5,296	91	102,968	2,323	200,403	4,314
Saugers	3,026,565	75,313			3,026,565	75,313
Sheepshead	1,147,122	7,651			1,380,190	9,513
Sturgeon	789,402	53,392	189,955	17,753	1,130,148	81,128
Suckers, fresh	1,568,734	18,077	278,738	5,101	3,801,856	52,205
Suckers, salted					242,131	3,863
Sun-fish	175,440	4,362	148,449	2,099	385,201	7,204
Trout, fresh	32,024	1,736	15,432	853	10,068,730	412,137
Trout, salted					542,858	19,139
White bass	1,596,524	30,603	2,300	92	1,603,204	30,841
White-fish, fresh	2,066,314	152,009	161,935	10,978	4,937,131	289,334
White-fish, salted					156,883	7,689
Other fish	540	5	22,700	1,593	24,471	1,754
Crawfish					135,861	3,498
Frogs	982	172	1,750	306	10,732	998
Turtles	67,211	2,324			67,211	2,324
Total	58,393,864	1,150,895	2,407,132	101,040	113,728,040	2,611,482

The following shows the quantity and value by lakes for the years 1885, 1890, 1893, and 1899:

Yield of the fisheries of the Great Lakes in 1885, 1890, 1893, and 1899.

Lakes.	1885.		1890.		1893.		1899.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Lake Superior	8,825,980	$291,523	6,115,992	$220,968	8,096,927	$252,107	5,429,654	$150,862
Lake Michigan	23,518,148	878,788	26,434,266	830,465	30,747,755	828,611	34,499,996	876,743
Lake Huron	11,457,170	276,397	10,056,381	221,067	12,064,338	306,381	12,418,327	308,078
Lake St. Clair, St. Clair and Detroit rivers	2,185,795	40,193	2,994,571	73,577	1,814,311	46,030	579,067	23,864
Lake Erie	51,456,517	1,109,096	64,850,873	1,000,905	42,968,325	805,979	58,393,864	1,150,895
Lake Ontario	2,398,466	95,869	3,446,448	124,786	928,015	31,510	2,407,132	101,040
Total	99,842,076	2,691,866	113,898,531	2,471,768	96,619,671	2,270,618	113,728,040	2,611,482

STURGEON FISHERY OF FLORIDA.

The sturgeon fishery of Florida has never been of great importance, from the fact that while sturgeon are quite numerous in the bays and rivers of both the eastern and western parts of the State the supply has generally become exhausted after a few seasons in all localities where, in former years, the fishery has been prosecuted.

In eastern Florida the catch of sturgeon in 1889 was 40,620 pounds, and in 1890 it was 28,055 pounds, but since that time none have been taken. The catch in Tampa Bay, on the western side of the State, during the winter of 1886 and 1887 was about 1,500 sturgeon, which yielded 5,000 pounds of caviar. The following season over 2,000 fish were secured and nearly 6,300 pounds of caviar prepared. The next season only 7 fish were taken and the fishery was then abandoned. Since 1895 there has been more or less sturgeon fishing in the Suwanee River, but it is reported that the fish are now becoming scarce. The season during which sturgeon are taken in the Suwanee extends from February 1 to May 1, and the fishing is done with gill nets. In the Ocklockonee River sturgeon fishing was prosecuted successfully in 1898 and 1899, but very few sturgeon have since been caught there. In the Apalachicola River sturgeon fishing began in 1899 and is still being carried on successfully, but whether the supply will become exhausted in three or four seasons, as has been the case with some of the other rivers of this section, is a matter yet to be determined.

Mr. J. N. Cobb has recently, in connection with other fishery investigations, collected statistics respecting the sturgeon fishery in western Florida in 1900. There were 84 persons engaged in the industry, and the investment amounted to $8,157. The yield of sturgeon, at round weight, for the Suwanee River was 44,400 pounds; for the Ocklockonee River, 37,100 pounds, and for the Apalachicola River, 84,000 pounds. These rivers are the only ones where sturgeon are now taken. The total value of sturgeon products for western Florida was $12,901.

In the following table, showing the extent of the sturgeon fishery of Florida in 1900, the round and dressed weights of the catch are given:

Table showing by waters the number of persons and the amount of capital employed and the yield of the sturgeon fishery of Florida in 1900.

Items.	Suwannee River.		Ocklockonee River.		Apalachicola River.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons employed	18		19		47		84	
Boats, apparatus, etc.:								
Steamboats			1	$2,000	1	$2,500	2	$4,500
Rowboats, etc	8	$1,290	10	290	20	400	38	1,980
Gill nets	9	162	22	220	20	600	*51	982
Shore property		95		400		200		695
Total		1,547		2,910		3,700		8,157
PRODUCTS.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Sturgeon (round weight)	44,400		37,100		84,000		165,500	
Sturgeon (dressed weight)	22,200	$2,664	19,350	$2,322	40,000	$4,800	81,550	$9,786
Caviar	1,260	1,008	850	595	2,160	1,512	4,270	3,115
Total		3,672		2,91		6,312		12,901

*4,930 yards.

SPONGE FISHERY OF FLORIDA.

The total number of persons engaged in the sponge fishery of Florida in 1900 was 2,245; the investment in vessels, boats, fishing apparatus, and shore property was $594,598; and the products amounted to 364,990 pounds, valued at $567,685. These figures indicate a decided increase in the yield of this fishery in recent years. The catch was slightly less than in 1890, but prices have been constantly advancing and the value of the output is now greater than ever before. "Sheepswool" sponges are more abundant than at any time since 1895, but there is a marked decrease in the yield as compared with earlier years. This decline, which is probably temporary, has apparently resulted in a larger demand for other grades. The increase in the catch of "yellow" and "grass" sponges has therefore more than compensated, both in quantity and value, for the decline in "sheepswool."

The following tables show in detail the extent of the sponge fishery for the year 1900, and also a comparison of the yield and value for the years 1895, 1896, 1899, and 1900:

Sponge fishery of Florida, 1900.

Items.	Key West.		Tarpon Springs.		Apalachicola.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons employed:								
Vessel fishermen	1,080		120		39		1,239	
Boat fishermen	669		180		25		874	
Shore employees	78		54				132	
Total	1,827		354		64		2,245	
Vessels, boats, etc.:								
Vessels	136	$167,170	15	$11,831	5	$3,150	156	$182,151
Tonnage	1,584		129		37		1,750	
Outfit		100,950		11,103		3,446		115,499
Boats	183	146,450	40	28,100	5	3,915	228	[1]178,465
Apparatus used in vessel fisheries		2,704		353		96		3,153
Apparatus used in boat fisheries		2,458		720		45		3,223
Shore and accessory property		99,200		12,907				112,107
Total		518,932		65,014		10,652		594,598
KINDS AND GROUNDS.[2]	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Catch by vessels on "Bay" grounds:								
Sheepswool	79,466	$229,401	12,572	$37,046	1,640	$4,834	93,678	$271,281
Yellow	15,177	11,305	2,376	1,584	464	309	18,017	13,198
Grass	26,731	8,140	8,195	2,185	585	156	35,511	10,481
Glove	948	134					948	134
Velvet or boat	386	64					386	64
Total	122,708	249,044	23,143	40,815	2,689	5,299	148,540	295,158
Catch by vessels on "Key" grounds:								
Sheepswool	19,199	41,856					19,199	41,856
Yellow	10,010	8,603					10,010	8,603
Grass	18,266	5,778					18,266	5,778
Glove	3,748	542					3,748	542
Velvet or boat	2,141	1,752					2,141	1,752
Total	53,364	58,531					53,364	58,531

[1] Includes value of outfit.

[2] "Bay" grounds, i. e., Gulf of Mexico; "Key" grounds, i. e., vicinity of the islands of southern Florida.

Sponge fishery of Florida, 1900—Continued.

Kinds and grounds.	Key West.		Tarpon Springs.		Apalachicola.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Catch by boats on "Bay" grounds:								
Sheepswool	19,674	$57,609	8,423	$24,820	996	$2,934	29,093	$84,763
Yellow	3,793	2,827	2,670	1,780	438	292	6,901	4,899
Grass	6,683	2,035	10,894	2,905	360	96	17,937	5,036
Glove	237	34					237	34
Total	30,387	61,905	21,987	29,505	1,794	3,322	54,168	94,732
Catch by boats on "Key" grounds:								
Sheepswool	39,341	85,363					39,341	85,363
Yellow	20,250	17,345					20,250	17,345
Grass	37,551	11,968					37,551	11,968
Glove	7,495	1,084					7,495	1,084
Velvet or boat	4,281	3,504					4,281	3,504
Total	108,918	119,264					108,918	119,264
Grand total	315,377	488,744	45,130	70,320	4,483	8,621	364,990	567,685

Yield and value of the sponge fishery in 1895, 1896, 1899, and 1900.

Kinds.	1895.		1896.		1899.		1900.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Sheepswool	231,272	$363,107	149,724	$248,196	153,700	$332,390	181,311	$483,263
Yellow	29,509	11,798	23,655	9,318	55,800	16,205	55,178	44,045
Grass	21,387	5,464	44,617	11,508	76,900	14,319	109,265	33,263
Other	23,952	6,502	18,315	3,990	18,000	5,000	19,236	7,114
Total	306,120	386,871	236,311	273,012	304,400	367,914	364,990	567,685

FISHERIES OF THE MISSISSIPPI RIVER AND TRIBUTARIES.

A condensed statement of the results of the investigations of the Mississippi River and tributaries has already been published as statistical bulletin No. 107.

The total number of persons engaged in the fisheries of these waters was 11,218, the capital invested amounted to $1,883,875, and the products aggregated 94,713,402 pounds, valued at $1,771,812.

The most important apparatus of capture employed in these fisheries is fyke nets. They exceed in value all other forms of apparatus, and are more extensively used in this region than in all the other fishing sections of the United States combined.

Among the products of these fisheries, buffalo-fish is most prominent, the yield being 14,215,975 pounds, valued at $349,913. Cat-fish is also very abundant, the quantity taken being 7,648,179 pounds, valued at $339,800. German carp stands next in value and is greater in quantity, the catch being 11,868,840 pounds, valued at $289,258. Mussel shells constitute another important product, due to their use in the manufacture of pearl buttons, the quantity secured being 45,564,000 pounds, for which the fishermen received $207,187. Other important products were crappie, worth $61,400; black bass, worth $56,652; paddle-fish, worth $55,514; suckers, worth $40,340; frogs, $53,054

Since the canvass of these fisheries for 1894 there has been a large increase in the quantity and value of products. The products of the fisheries of the Illinois River, the most important tributary of the Mississippi from a fishery point of view, have more than doubled in quantity and value during that period, and are now worth $386,284, more than two-thirds of which was received for German carp. There has also been a substantial increase in the fisheries of other rivers. In 1899 the fishery products of this river system were greater in quantity and nearly equal in value to the entire output of all the interior waters, exclusive of the Great Lakes, of the United States in 1894.

Fisheries of the Mississippi River and tributaries, 1899.

Items.	Mississippi River and minor tributaries.		Missouri River and tributaries.		Illinois River and tributaries.		Ohio River and minor tributaries.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons employed	7,059		820		1,017		1,102	
Boats	4,033	$76,795	686	$8,237	698	$37,658	1,095	$19,293
Hand and set lines		6,086		897		844		3,285
Crowfoot grapples, rakes, forks, and dredges[1]		10,393						
Seines	511	36,803	121	4,124	140	20,069	180	7,500
Fyke nets	16,119	75,548	1,135	5,457	7,421	41,465	3,703	23,084
Gill nets	4	30			12	240	2	15
Pound nets	02	2,660						
Trammel nets	355	8,200	48	1,077	44	1,047		
Shrimp traps	5,276	987						
Other apparatus		1,791				936		27
Shore and accessory property		594,773		125,217		11,614		51,466
Cash capital		473,150		133,300				
Total investment		1,287,216		278,309		113,873		104,670
PRODUCTS.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	275,073	$17,122	3,970	$383	104,589	$9,309	11,119	$1,090
Buffalo-fish	7,616,889	173,604	549,012	20,934	2,324,552	64,032	407,020	20,260
Carp, German	3,272,716	65,525	44,915	1,587	8,426,887	215,305	90,862	4,836
Cat-fish	3,445,775	141,497	467,038	30,403	976,845	35,802	723,449	37,894
Crappie	480,348	21,208	10,837	776	295,134	11,670	7,907	585
Dog-fish	8,250	56			802,750	8,695		
Drum or sheepshead	1,448,900	30,589	99,435	3,834	245,068	5,075	610,451	37,075
Eels	52,651	2,559	2,525	224	10,203	498	6,061	388
Hickory shad	12,430	32			5,000	75	250	20
Moon-eye	6,300	197					10,726	489
Paddle-fish	1,880,061	41,315	99,900	3,348	26,515	1,082	119,179	5,495
Pike or pickerel	159,871	5,126	15,330	1,058	17,111	1,078	30	5
Pike perch (wall-eyed)	144,314	7,196	10,890	668	11,526	674	13,778	1,379
Rock bass	50,900	2,381			43,074	962	4,831	425
Saugers or sand pike	32,620	1,202					6,240	556
Shad							6,955	355
Sturgeon, lake	178,881	5,220	25,520	1,061	635	23	14,161	835
Sturgeon, shovel-nose	496,614	9,681	75,120	3,118	18,374	378	64,661	3,076
Suckers	980,151	22,158	297,290	10,944	67,790	1,400	402,293	23,044
Sun-fish	171,261	4,467			508,180	10,931	4,740	273
White bass	28,015	1,327	2,140	112	109,933	3,861		
Yellow perch	17,281	389	600	27	12,700	280	33,720	1,946
Other fish	3,810	119					250	18
Frogs	170,872	18,801			26,610	3,224	350	210
Turtles and terrapin	198,954	3,834			547,916	11,950	13,825	658
Shrimp	200,058	16,095						
Mussel shells	45,564,000	[2]207,187						
Alligator hides	3,750	938						
Otter skins	182	455						
Caviar	70,300	26,739						
Total products	66,971,227	827,014	1,704,522	78,477	14,581,392	386,284	2,552,858	140,912

[1] Apparatus used in the mussel fishery.

[2] Includes $9,842 worth of pearls and $5,525 worth of baroque pearls taken from mussel shells.

NOTE.—Several large rivers are classed above as minor tributaries on account of the compartively small importance of their fisheries.

Fisheries of the Mississippi River and tributaries, 1899—Continued.

Items.	Wabash River and tributaries.		Cumberland River.		Tennessee River.		St. Francis River and tributaries.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons employed	232		93		180		346	
Boats	231	$2,500	95	$1,044	233	$2,172	342	$7,995
Hand and set lines		355		385		1,219		504
Seines	18	700					27	1,870
Fyke nets	645	3,225	535	3,186	1,067	4,904	2,020	10,100
Pound nets							24	1,700
Trammel nets	1	40					52	1,700
Other apparatus		10				705		2,518
Shore and accessory property		365		6,453		21		2,910
Cash capital				15,000				
Total investment		7,195		26,068		9,021		29,297
PRODUCTS.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	7,413	$731	7,553	$429	10,792	$567	507,200	$25,363
Buffalo-fish	39,159	3,093	61,362	3,645	119,391	5,864	1,629,200	24,634
Carp, German	17,491	1,490	4,634	304			9,720	179
Cat-fish	126,417	10,321	62,410	4,615	366,795	18,306	487,000	17,762
Crappie	1,972	177	669	58	80	8	483,280	24,162
Drum or sheepshead	36,799	2,913	73,194	4,967	328,245	16,620	34,870	539
Eels	5,127	444	1,463	105	8,040	403	6,210	133
Hickory shad					165,055	8,282		
Moon-eye	340	20						
Paddle-fish	3,590	169	6,540	328	145	4	9,120	179
Pike or pickerel							23,910	728
Pike perch (wall-eyed)	8,119	779	1,056	119	14,492	934	4,287	217
Rock bass	4,460	411	1,190	125	82	8	20,320	928
Saugers or sand pike			463	41				
Sturgeon, lake			5,178	436	9,770	489		
Sturgeon, shovel-nose	10,131	744	5,648	412	32,170	1,368	475	5
Suckers	70,282	5,245	10,914	843	200,469	10,098	144,410	2,178
Sun-fish	8,109	774	2,068	190			200,430	3,400
White bass	1,742	167						
Yellow perch			705	44				
Frogs							243,164	30,819
Turtles and terrapin	3,320	186					16,100	482
Otter skins							1,262	3,155
Total products	344,471	27,664	245,047	16,661	1,255,526	62,951	3,820,958	134,863

Items.	Yazoo River.		Red River and tributaries.		White River and tributaries.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons employed	150		127		92		11,218	
Boats	109	$2,310	171	$5,239	124	$1,004	[1]7,817	$164,247
Hand and set lines		915		627		563		15,680
Crowfoot grapples, rakes, forks, dredges								10,393
Seines			50	600	10	575	1,057	72,241
Fyke nets	1,390	8,340	426	2,101	575	3,104	35,036	180,514
Gill nets							18	285
Pound nets					1	40	87	4,400
Trammel nets			40	320	27	695	567	13,079
Shrimp traps							5,276	987
Other apparatus		13		283				6,283
Shore and accessory property		1,111		295		91		794,316
Cash capital								621,450
Total investment		12,689		9,465		6,072		1,883,875
PRODUCTS.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	1,600	$80	6,300	$518	12,575	$1,060	948,184	$56,652
Buffalo-fish	632,590	9,489	405,950	8,371	430,850	15,987	14,215,975	349,913
Carp, German	1,615	32					11,868,840	289,258
Cat-fish	107,900	3,237	453,050	14,672	431,500	25,291	7,648,179	339,800
Crappie	2,050	94	7,980	578	28,575	2,089	1,318,832	61,400
Dog-fish							811,000	8,751
Drum or sheepshead	91,520	1,378	104,700	2,877	76,050	2,919	3,149,232	108,786
Eels	1,365	41	260	8			93,905	4,803
Hickory shad							182,735	8,409

[1] Includes 2 small registered vessels and 21 launches and steamboats under 5 tons.

Fisheries of the Mississippi River and tributaries, 1899—Continued.

Products.	Yazoo River.		Red River and tributaries.		White River and tributaries.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Moon-eye							17,366	$706
Paddle-fish	327,000	$3,570	1,200	$24			2,473,250	55,514
Pike or pickerel	350	25	300	18	50	$7	216,952	8,045
Pike perch (wall-eyed)			250	29	1,400	161	210,112	12,156
Rock bass	2,320	110	2,200	132			129,377	5,482
Saugers or sand pike							39,323	1,799
Shad							6,955	355
Sturgeon, lake							234,145	8,064
Sturgeon, shovel-nose					8,500	360	711,693	19,142
Suckers	65,900	989	3,700	66	700	28	2,243,899	40,340
Sun-fish					16,175	1,283	910,963	21,318
White bass					7,250	545	149,080	6,012
Yellow perch							65,006	2,666
Other fish							4,069	137
Frogs							440,996	53,054
Turtles and terrapin			1,900	38			782,015	17,148
Shrimp							[1] 200,058	16,095
Mussel shells							45,564,000	207,187
Alligator hides			1,200	300			[2] 4,950	1,238
Otter skins	10	25	166	415			[3] 1,620	4,050
Caviar	400	140					70,700	26,879
Total products	1,234,620	19,210	989,156	28,046	1,013,625	49,730	94,713,402	1,771,812

[1] 33,343 gallons. [2] 990 in number. [3] 810 in number.

CAVIAR FROM PADDLE-FISH.

The paddle-fish, or "spoon-bill cat," is taken in considerable quantities in the Mississippi River and some of its tributaries. The catch in 1894 amounted to 1,037,395 pounds, valued at $20,972, and in 1899 had increased to 2,473,250 pounds, valued at $55,514. Until within a few years past only the flesh of this fish was marketed, but about 1896 the fishermen in various States along the lower part of the Mississippi River began to utilize the roe in the manufacture of caviar. This product is said to be less desirable in flavor than the caviar made from the roe of the sturgeon, and is marketable chiefly because the sturgeon caviar has become scarce and expensive. It is shipped to Chicago and New York.

The following table shows, by States, the quantity and value of paddle-fish caught and of caviar prepared in 1899:

States.	Paddle-fish.		Caviar.	
	Lbs.	Value.	Lbs.	Value.
Arkansas	551,405	$11,967	34,175	$11,488
Illinois	195,174	6,210		
Indiana	34,125	1,308		
Iowa	36,390	1,128		
Kansas	7,850	265		
Kentucky	147,260	4,919		
Louisiana	132,200	1,960	3,750	1,000
Mississippi	948,305	16,739	32,775	14,391
Missouri	190,931	5,865		
Nebraska	16,375	444		
South Dakota	2,050	52		
Tennessee	211,185	4,657		
Total	2,473,250	55,514	70,700	26,879

FISHING IN THE INTERIOR WATERS OF TEXAS.

The investigations of the fisheries of Texas which have been made by this division have hitherto been limited to the coastal waters. Recent inquiries by Mr. Cobb respecting fishing in certain waters in the central and southeastern parts of the State show that an important amount of fresh-water fish is taken. In this inquiry the rivers were canvassed from the upper limits of tide water to as far as commercial fishing extended. The data related to the year 1900. Fishing was carried on in the Colorado, Brazos, Trinity, Neches, Guadalupe, San Jacinto, and Rio Grande rivers, and in Caddo Lake, tributary to the Red River. The most important of these was the Colorado River. The inquiries on the Rio Grande were very limited.

Commercial fishing in the interior waters of Texas is of comparatively recent date in most of the sections of the State. In the western and northwestern portions, where the population is scattered and railroad facilities are limited, very little fishing is done, while the lack of ice or its high price prevents the utilization of the fishery resources even in those sections where the shipping facilities are fairly good. It is only in the larger towns that ice is cheap. Fishermen at present depend upon the home market for the sale of their catch, and, as it is easily overstocked, fishing is frequently suspended.

In all 188 persons were employed, and 169 boats, valued at $765, were in use. Set and hand lines, fyke nets and seines were used in fishing, and their value, together with that of the shore property necessary to the business, amounted to $1,831. By far the greater part of the catch consisted of cat-fish, of which there were taken 202,170 pounds, valued at $11,961. Buffalo-fish is the next in importance, the quantity taken amounting to 28,295 pounds, worth $1,436. The total yield of all species in the waters named amounted to 266,871 pounds, valued at $16,153.

The following tables show by waters the persons employed, capital invested, and the yield of these fisheries in 1900.

Table showing the persons, boats, apparatus, and shore property employed in the fisheries of certain interior waters of Texas in 1900.

Waters.	Persons employed.	Boats.		Set lines.		Hand lines.	Fyke nets.		Seines.		Shore and accessory property.	Total investment.
		No.	Value.	Yards.	Value.	Value.	No.	Value.	No.	Value.		
Colorado River	65	63	$254	15,567	$98	-------	90	$360	----	-------	$100	$812
Brazos River	18	18	86	2,117	20	-------	11	44	----	-------	52	202
Trinity River	12	12	65	3,200	23	-------	26	116	----	-------	45	249
Neches River	4	4	20	1,600	8	-------	8	32	----	-------	5	65
Guadalupe River	29	29	145	3,270	18	$8	11	55	----	-------	185	411
Rio Grande River	18	18	90	2,800	23	-------	----	-------	2	$40	33	186
San Jacinto River	15	15	75	4,000	22	-------	60	300	----	-------	145	542
Caddo Lake	12	10	50	4,800	24	-------	----	-------	----	-------	75	149
Total	173	169	785	37,354	236	8	206	907	2	40	640	2,616

Table showing the yield of fisheries of certain interior waters of Texas in 1900.

Waters.	Black bass.		Buffalo.		Cat-fish.		Crappie.		Drum.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Colorado River	2,076	$172	8,866	$648	67,910	$4,866	.....	.....	8,894	$765
Brazos River	410	33	1,092	73	8,750	609	.....	.....	673	20
Trinity River	500	50	2,314	109	22,400	1,210	200	$8	1,050	45
Neches River	299	30	380	19	8,300	415	.....	.....	200	10
Guadalupe River	3,960	333	4,343	192	39,900	1,875	2,830	142	.....	.....
Rio Grande River	.....	.....	300	12	21,210	1,301	.....	.....	.....	.....
San Jacinto River	780	78	600	18	32,000	1,600	.....	.....	1,200	48
Caddo Lake	.....	.....	10,400	365	1,700	85	.....	.....	550	11
Total	8,025	696	28,295	1,436	202,170	11,961	3,030	150	12,567	899

Waters.	Eels.		Mullets.		Suckers.		White perch.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Colorado River	156	$12	1,165	$105	5,965	$446	.....	.....	95,032	$7,014
Brazos River	.....	.....	.....	.....	1,200	36	.....	.....	12,125	771
Trinity River	.....	.....	.....	.....	.....	.....	1,600	$160	28,064	1,582
Neches River	.....	.....	.....	.....	.....	.....	170	17	9,349	491
Guadalupe River	328	15	.....	.....	.....	.....	.....	.....	51,361	2,557
Rio Grande River	.....	.....	.....	.....	.....	.....	.....	.....	21,510	1,313
San Jacinto River	.....	.....	.....	.....	.....	.....	2,200	220	36,780	1,964
Caddo Lake	.....	.....	.....	.....	.....	.....	.....	.....	12,650	461
Total	484	27	1,165	105	7,165	482	3,970	397	266,871	16,153

COMMERCIAL FISHING IN NEVADA.

Recent fishery inquiries made in Nevada and Utah by Mr. E. A. Tulian indicate important increases in the commercial fisheries of certain minor interior waters of this generally arid region of the West. The investigations in Utah are not yet completed, but those for Nevada show a decided improvement since the fisheries were canvassed in 1895. At that time the yield consisted of 28,690 pounds of trout, worth $2,023. In 1900 107,536 pounds of trout and black bass were taken, the value of which was $12,834. The fishery is carried on in a rather desultory manner, the number of persons engaged in it from time to time being 120. The investment in the fishing business amounted to $1,905. The following tables present statistics of the fishing industry of Nevada for 1900:

Table showing the persons, boats, apparatus, and shore property employed in the fisheries of Nevada in 1900.

Waters.	Persons employed.	Boats.		Lines.		Shore and accessory property.	Total investment.
		No.	Value.	No.	Value.		
Pyramid Lake	38	35	$875	35	$105	$200	$1,180
Mud Lake	2	2	50	1	3	100	153
Walker Lake	10	10	200	10	30	100	330
Truckee River	70	.....	.....	70	242	.....	242
Total	120	47	1,125	116	380	400	1,905

Table showing the yield of the fisheries of Nevada in 1900.

Waters.	Black bass.		Trout.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pyramid Lake	.....	.....	43,543	$4,641	43,543	$4,641
Mud Lake	.....	.....	5,044	504	5,044	504
Walker Lake	5,500	$275	2,500	375	8,000	650
Truckee River	.....	.....	50,949	7,039	50,949	7,039
Total	5,500	275	102,036	12,559	107,536	12,834

FISHERIES OF THE PACIFIC COAST.

A canvass of the fisheries of the Pacific coast States for 1899, the general results of which were announced in a statistical bulletin, No. 20, shows these important fisheries to be now more extensive than during any previous year for which full records exist. This is due chiefly to the great development of the salmon-canning industry in northern Washington.

In 1899 there were employed in the fisheries of these States 19,528 persons. The total investment in the industry was $12,873,379, and the products, amounting to 217,965,156 pounds, were valued at $6,278,639.

Since the last canvass of these fisheries (for 1895) the number of persons engaged has increased by 2,223. The increase in the investment amounts to $5,599,200, while the increase in yield and value amounts to 70,733,977 pounds and $1,808,687.

Although the fisheries in general have increased in both Washington and California, there has been a falling off in the yield and value of the fisheries of Oregon, traceable to a smaller catch of salmon in the Columbia River.

The amount of capital invested in the fisheries of California has not changed materially since 1895. In Washington the investment has increased by $4,576,774.

Salmon constitute by far the most important feature of the fisheries, the yield for 1899 being worth at first cost $3,504,622. The next item in importance is oysters, worth $1,043,192. The oyster industry consists chiefly in the growing of the seed of eastern oysters transplanted to San Francisco Bay. Other important fisheries are whale products, worth $456,733; cod, worth $201,304; halibut, worth $192,580; shrimp, worth $107,957, and crabs, worth $99,518, all other items being represented by smaller amounts.

The following table presents, by States, statistics of the fisheries of this region for 1899:

Fisheries of the Pacific Coast States, 1899.

Items.	Washington.		Oregon.		California.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons employed	9,911		5,643		3,974		19,528	
Vessels fishing	32	$72,400	1	$6,000	33	$700,870	66	$779,270
Tonnage	889		59		5,952		6,900	
Outfit		44,715		335		413,287		458,337
Vessels transporting	72	275,200	30	66,300	15	55,800	117	397,300
Tonnage	1,222		330		834		2,386	
Outfit		86,314		4,490		4,220		95,024
Boats	2,566	233,475	1,830	198,240	1,355	150,335	5,751	582,050
Pile-drivers	30	63,283	1	1,000			31	64,283
Seines	205	93,420	46	19,910	115	13,230	366	126,560
Pound nets	540	1,552,650	65	45,200			605	1,597,850
Gill nets	1,900	119,591	2,067	297,700	1,979	166,841	5,946	584,132
Trammel nets					591	26,280	591	26,280
Hoop nets			2,325	1,829	1,537	3,074	3,862	4,903
Shrimp nets					1,370	27,800	1,370	27,800
Fyke nets	70	700	36	360	356	1,424	462	2,484
Wheels (salmon)	29	66,300	47	121,300			76	187,600
Beam trawls					4	1,400	4	1,400
Lobster pots					578	664	578	664
Dredges, tongs, rakes, etc		3,553		191		156		3,900
Lines—hand and trawl		6,418		400		4,240		11,058
Other apparatus		2,355		240		4,522		7,117
Shore property		1,200,892		1,173,148		820,650		3,194,690
Cash capital		2,779,977		1,561,000		379,700		4,720,677
Total investment		6,601,243		3,497,643		2,774,493		12,873,379

Fisheries of the Pacific Coast States, 1899—Continued.

Products.	Washington.		Oregon.		California.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Albacore					85,776	$2,912	85,776	$2,912
Barracuda, fresh					957,420	23,220	957,420	23,220
Barracuda, salted					234,085	9,483	234,085	9,483
Black cod	163,500	$4,475					163,500	4,475
Bonito					119,737	3,893	119,737	3,893
Carp, German					283,514	2,400	283,514	2,400
Cat-fish	105,700	2,114	54,360	$1,087	465,911	12,734	625,971	15,935
Cod, salted	930,000	23,250			5,917,131	178,054	6,847,131	201,304
Cultus-cod	91,000	1,530			147,890	3,298	238,890	4,828
Flounders	28,000	560	3,522	53	3,352,140	57,551	3,383,662	58,164
Halibut	6,860,640	191,220	17,000	1,360			6,877,640	192,580
Halibut, bastard					1,375,410	35,127	1,375,410	35,127
Hardhead					185,882	5,849	185,882	5,849
Herring	424,000	2,820	19,120	347	1,637,017	17,683	2,080,137	20,850
Jew-fish					66,000	1,951	66,000	1,951
King-fish					127,198	4,483	127,198	4,483
Mackerel					153,666	6,415	153,666	6,415
Perch	43,000	770	6,360	95	432,485	10,777	481,845	11,642
Pompano					13,135	4,457	13,135	4,457
Rock-fish	72,000	1,440			1,232,810	38,186	1,304,810	39,626
Salmon:								
Chinook, fresh	10,702,189	387,120	13,744,810	659,213	7,084,885	255,249	31,531,884	1,301,582
Chinook, salted	118,220	5,911	2,400	75	3,000	210	123,620	6,196
Blueback, fresh	41,931,194	1,307,514	579,183	21,293	21,600	755	42,531,977	1,329,562
Blueback, salted	70,000	2,801					70,000	2,801
Silver, fresh	20,606,686	364,287	5,154,375	97,281	60,160	2,105	25,821,221	463,673
Silver, salted	21,000	630					21,000	630
Steelhead, fresh	1,507,465	69,242	1,103,522	48,014	113,600	3,876	2,724,587	121,132
Humpback, fresh	18,579,907	133,059					18,579,907	133,059
Humpback, salted	1,266,093	31,653					1,266,093	31,653
Dog, fresh	6,522,629	109,940	789,615	3,948			7,312,244	113,888
Dog, salted	22,302	446					22,302	446
Salmon trout	44,000	3,080					44,000	3,080
Sardines					2,389,826	17,967	2,389,826	17,967
Sea bass	5,000	150			938,156	20,492	943,156	20,642
Shad	85,000	1,275	32,000	320	1,137,801	14,303	1,254,801	15,898
Smelt	937,000	9,810	28,000	340	1,315,249	58,064	2,280,249	668,214
Striped bass					1,234,320	61,814	1,234,320	1,814
Sturgeon	89,685	3,907			205,659	11,426	295,344	15,333
Tomcod					375,538	6,882	375,538	6,882
Yellow-tail					204,644	6,677	204,644	6,677
Other fish					490,644	11,785	490,644	11,785
Abalone meats					369,411	22,813	369,411	22,813
Oysters	5,901,320	174,567	59,100	1,625	28,800,000	867,000	34,760,420	1,043,192
Clams	3,131,325	23,248	979,290	9,434	2,170,934	31,045	6,281,549	63,727
Mussels	19,200	240			364,076	3,637	383,276	3,877
Crabs	274,696	11,119	110,604	2,615	3,676,680	85,784	4,061,980	99,518
Crawfish			116,400	7,760			116,400	7,760
Spiny lobster					606,713	14,198	606,713	14,198
Shrimp	19,600	1,960			903,375	36,135	922,975	38,095
Shrimp, dried					698,625	69,862	698,625	69,862
Squid, dried					622,740	18,682	622,740	18,682
Frogs					20,687	20,638	20,687	20,638
Terrapin					107,869	10,376	107,869	10,376
Whalebone					207,392	436,272	207,392	436,272
Whale oil	15,000	300			507,300	20,191	522,300	20,491
Other products	375	1,000	18,750	890	3,140,928	24,740	3,160,053	26,630
Total	120,587,726	2,871,438	22,818,411	855,750	74,559,019	2,551,451	217,965,156	6,278,639

The above values of products are those received by the fishermen. Salmon, fresh, includes the quantity afterwards canned, the value of which is thereby greatly increased, as shown below:

Quantity and value of salmon canned in 1899.

Salmon.	Washington.		Oregon.		California.		Total.	
	Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
Chinook	95,147	$482,161	214,821	$1,212,566	34,180	$159,468	344,148	$1,854,195
Blueback	503,950	2,388,644	19,665	114,413			523,615	2,503,057
Silver	145,139	544,824	78,730	292,765			223,869	837,589
Dog	42,656	116,284	18,345	54,480			61,001	170,764
Humpback	252,733	734,241					252,733	734,241
Steelhead	2,258	9,175	9,736	30,011			11,994	39,186
Total	1,041,883	4,275,329	341,297	1,704,235	34,180	159,468	1,417,360	6,139,032

Number of canneries: Washington, 28; Oregon, 28; California, 4.

The following shows the yield of the fisheries for certain years, exclusive of value of canned salmon:

Yield of the fisheries of the Pacific coast States in 1888, 1892, 1895, and 1899.

Year.	Washington.		Oregon.		California.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
1888	18,914,336	$763,108	25,169,266	$1,010,843	23,313,324	$1,091,398	67,576,926	$2,865,349
1892	36,757,287	931,568	28,521,105	872,405	57,838,466	3,022,991	186,268,193	6,245,192
1895	59,079,527	1,401,433	34,141,632	1,282,036	50,010,020	1,786,483	147,231,179	4,469,952
1899	120,587,726	2,871,438	22,818,411	855,750	74,559,019	2,551,451	217,965,156	6,278,639

CONDITION OF THE PRIBILOF FUR-SEAL ROOKERIES.

During the month of July, 1900, Mr. Townsend visited the Pribilof Islands for the purpose of procuring information respecting the condition of the fur-seal rookeries. The customary data, consisting chiefly of actual counts of the number of harems upon each breeding-ground and of the number of seals born during the season, were secured.

Between July 12 and 19 the harems were counted on all rookeries. Counts were made of the seals born on certain rookeries upon which counts have been made systematically for several years. Counts were also made of the pup seals that died on the rookeries from natural causes prior to the loss resulting from pelagic sealing. During the killing season records were kept of the proportion of seals rejected from the drives.

The seals have been diminishing in number upon the breeding-grounds for many years, the annual decrease during the past few years amounting to about 20 per cent. The percentage of decrease has been based chiefly upon the counts of pups. The counts for the season of 1900 did not reveal a decrease in the number of seals born as compared with the previous season. This is traceable to the light pelagic catch made in 1897. The census of breeding females in 1897 placed the number at 129,216. A census of the same class of seals in July, 1900, shows the total number to be 100,634. This shows a reduction of 28,572 breeding females since 1897.

The seals available for killing upon the islands have heretofore consisted of 3-year-old males, the number taken becoming less from year to year until 1899, when 16,812 were secured. During the past season only about 9,000 seals of this class could be found. The price of skins being higher than usual, a number of 2-year-olds were taken, the number from both classes amounting to 21,994. This departure from the custom of the lessees was brought about by the high price of skins, and will result in a diminished catch of 3-year-olds next season.

The average weight of skins taken on the islands is 9 to 10 pounds, but the small seals included in the quota for the present season reduced the average weight to 6 or 6½ pounds.

Sufficient numbers of seals are always absent from the killing-grounds when drives are made which later recruit the ranks of breeding males. There is no lack of large males in the breeding rookeries, the reduction in breeding females through pelagic sealing being relatively greatly in excess of any killing of males on land. During the past five years the killings of males on land have been as follows: 1896, 30,654; 1897, 19,200; 1898, 18,032; 1899, 16,812; 1900, 21,944. The majority taken in 1900 were 2-year-olds. During the same period the pelagic catch from the American herd, chiefly females, has been as follows: 1896, 43,917; 1897, 24,322; 1898, 27,689; 1899, 34,647; 1900, 35,427.

The increased pelagic catches of the past two seasons do not indicate any increase in the size of the seal herd, and too much importance should not be attached to the continued success of the pelagic sealing fleet. The fleet at present is about half the size it was a few years ago, and the average per vessel is still good, but it must not be supposed that a fleet of the original size could now make such catches as were made formerly. The pelagic catch can not show the condition of the seal herd; that can only be known from the conditions existing on the breeding rookeries. The pelagic catch in Bering Sea consists chiefly in nursing females and is followed by a loss of pup seals upon the islands equal to the number of females killed. The increased catch of the season, with the accompanying loss of pups, may be expected to show a great reduction of the seal herd upon the islands next season.

Upon the return of Mr. Townsend a detailed report of the investigation was made to the Treasury Department.

NOTE ON THE WHALE FISHERY.

The American whaling fleet is now composed of 22 vessels in the Atlantic Ocean and 18 vessels in the Pacific Ocean. Since 1890 the fleet has been gradually reduced from 97 vessels, aggregating 22,464 tons, to 40 vessels, with a total of 8,746 tons. The decrease in number and tonnage has been caused by withdrawals and the loss of vessels at sea in about equal numbers, very few additions having been made to the fleet.

The whaling vessels of the Atlantic Ocean are nearly all engaged in the capture of sperm whales, the catch of whalebone being made almost entirely by vessels of the Pacific fleet. In 1900 the yield of sperm oil, amounting to 18,525 barrels, and of whale oil, amounting to 5,510 barrels, was a little larger than for 1899, but the yield of whalebone, amounting to 207,650 pounds, was only two-thirds that of the preceding year.

In 1900 the schooner *Robert S. Graham*, of New Bedford, returned from Kerguelen Island with 2,600 barrels of sea-elephant oil. Only three voyages have been made in this fishery during recent years.

APPENDICES

TO

REPORT OF COMMISSIONER OF FISH AND FISHERIES.

NOTES ON THE FISHES AND MOLLUSKS OF LAKE CHAUTAUQUA, NEW YORK.

By BARTON WARREN EVERMANN and EDMUND LEE GOLDSBOROUGH.

In the last week in September, 1901, the senior writer of this paper spent four days at Chautauqua Lake, during which time he obtained specimens of most of the species of fishes and mollusks which inhabit it, together with a number of notes and descriptions on some of the more important species. Collecting was done in Clear Creek and Black Creek, small streams which enter the lake on the west side at Lighthouse Point, in the lake about their mouths, and at the various places along the north and northeast shores of the lake. Mollusks were also collected at different points about the north end of the lake.

Lake Chautauqua lies in the central part of Chautauqua County, which is situated in the extreme western part of the State of New York. The lake is a long and narrow body of water, with its main axis lying in a northwest and southeasterly direction. The length of the lake is about 22 miles, and the width varies from 3 miles to scarcely more than a quarter of a mile in its narrowest place. The greatest depth of the lake is said to be 80 feet, at a point between Chautauqua and Long Point. The water is said to be 62 feet deep quite close in to Long Point; but the greater portion of the lake is relatively shallow, and the depth probably does not average greater than 20 feet. The entire northern end seems quite shallow, probably not exceeding 15 or 20 feet at any place.

The lake is surrounded by gently sloping hills, the highest rising 200 or 300 feet above the water surface. These hills are, as a rule, all cultivated to the summits, and doubtless much sediment is carried into the lake from surface erosion on the surrounding cultivated ground. The shores of the lake are usually moderately abrupt, though nearly everywhere there is a strip of beach, more or less narrow and frequently wet or marshy. At the north end is a considerable tract of low ground, moderately timbered and inclined to be marshy. Around the shores and in shallow water are good growths of *Scirpus*, and water lilies were noticed in a few places. In the water were noted also such aquatics as *Myriophyllum*, *Ceratophyllum*, *Potamogeton*, and the like.

The elevation of the lake above sea level is given as 1,291 feet, and

726 feet above Lake Erie, from which it is distant only about 8 miles. Though so close to Lake Erie, Chautauqua Lake lies in the Ohio River hydrographic basin. Its outlet issues from the southern end as Conewango Creek, which, after being joined by Cassadaga Creek, enters the Allegheny River at Warren, Pa. The lake has no important inlets.

Situated as Lake Chautauqua is, in the Ohio basin, its fish fauna is essentially like that of other portions of that hydrographic basin. It more closely resembles that of the Lower Wabash than that of Lake Erie, though lying so close to the latter.

The most interesting feature of the fish fauna of Lake Chautauqua is the Chautauqua muskallunge, which is peculiar to this lake and the Ohio River. It is a food and game fish of great importance, and is propagated extensively by the State.

The special provisions of the law pertaining to fishing in Chautauqua Lake, as published in 1901 by the Forest, Fish, and Game Commission, are as follows:

SECTION 82 (*Fishing in Chautauqua Lake*).—Fish of any kind shall not be taken in Chautauqua Lake from May 1 to June 15, both inclusive, unless by the State for purposes of propagation. Black bass, yellow bass, rock bass, and muskallonge shall not be taken from December 1 to June 15, both inclusive, except as provided for in section 83.

SECTION 83 (*Chautauqua Lake exception*).—Muskallonge and bill-fish may be taken with spears, using fish houses and decoys, on Mondays and Thursdays of each week for five consecutive weeks, beginning on the first Monday in February. No such fish house, decoy, or spear shall be upon the ice or waters of Chautauqua Lake between the hours of 6 o'clock at night and 6 o'clock in the morning, or on any day except Monday or Thursday, as above provided. Bullheads may be fished for and taken through the ice with hooks and lines or tip-ups in Chautauqua Lake. All fish houses or other contrivances for hiding fishermen shall at all times be open to the inspection of peace officers or protectors, and unless in actual transit from the shore to or from a fishing place are hereby declared to be a public nuisance upon the ice or waters of Chautauqua Lake at all times not therein allowed. Such nuisance may be summarily abated by any officer or private person by the destruction thereof.

Briefly stated, the close season for black bass, yellow bass (*M. Dolomieu*), rock bass, and muskallunge extends from December 1 to June 15, both inclusive; the close season for all species from May 1 to June 15, both inclusive; black bass, yellow bass, rock bass, and muskallunge may be taken by angling from June 16 to November 30, both inclusive; muskallunge and bill-fish may be taken with spears on Mondays and Thursdays for five consecutive weeks, beginning with the first Monday in February; bullheads may be taken through the ice with hooks and line or tip-ups at any time. These provisions are well drawn and are apparently adequate for the protection of the food and game fishes of this lake.

The following lists are based chiefly upon the collections made during the visit to the lake already mentioned. Certain additional data obtained at other times have been included.

FISHES OF LAKE CHAUTAUQUA.

The classification and sequence of species in the following list follow that adopted by Jordan and Evermann in the Fishes of North and Middle America.

1. Polyodon spathula (Walbaum). *Paddle-fish; Spoon-bill Cat.*

The only record of the capture of this curious fish in this lake is that of a photograph by R. W. Banjean, of Mayville (situated at the head of the lake), of an example caught about 1890. The fish is said to have been 6 feet 2 inches in length, 4 feet around the body, and to have weighed 123½ pounds. This is one of the largest individuals of this species that has been recorded. The very largest of which we have a trustworthy record was taken in Lake Manitou, Indiana, and weighed 163 pounds.

2. Lepisosteus osseus (Linnæus). *Bill-fish; Long-nosed Gar; Gar Pike.*

3. Lepisosteus platostomus Rafinesque. *Bill-fish; Short-nosed Gar.*

These two species of wholly useless fishes are too abundant in this lake. In 1896 and 1897, at the request of the Farmers' and Citizens' Game and Fish Protective Association of Chautauqua County, two special appropriations of $1,000 and $500, respectively, were made by the legislature for the destruction of the gar pike or bill-fish, which, it was believed, were destroying the young bass and muskallunge in Lake Chautauqua. In 1896 netting for these fish was begun, and was continued in May and on into July, 1897. Seines, pound nets, and traps were used. The pound nets did the best work, and in 1887 these only were used. In 1896 there were caught and killed 2,606 bill-fish. The next year 1,316 were killed. In this latter year more nets were used and greater efforts put forth, but the smaller number of fish caught was doubtless due to the effect of the previous year's work, and it is now believed that with little more effort these fish can be practically exterminated.

Replying to a letter of inquiry, Mr. Charles H. Babcock, of the New York Forest, Fish, and Game Commission, says that "nothing has been done toward the extermination of the gar pike at Chautauqua Lake since 1897, with the exception of what has been done when we were taking muskallunge for propagating purposes in the spring of the year. A few have been taken each year since 1897 in that way, and they have always been destroyed. No appropriation has been made for the purpose since 1897, as the work was apparently very thoroughly done at that time. Very few, if any, gar pike have been seen or taken since then, from any information I can get. They are apparently a very much easier fish to get rid of than the carp."

4. Amia calva Linnæus. *Bowfin; Dog-fish.*

A local fisherman described a fish which he had seen in the lake, which was evidently this species. He called it "eel-pout." No examples were seen by us.

5. Ameiurus nebulosus (Le Sueur). *Small Cat-fish.*

Very abundant, reaching a weight of 1 to 3 pounds. Great numbers are caught; an important and excellent article of food.

6. Ameiurus melas (Rafinesque). *Common Bullhead.*

This is perhaps equally common with the former, but owing to its smaller size is of much less importance.

7. Schilbeodes miurus (Jordan). *Mad Tom; Stone Cat.*

This little fish is probably not common in the lake; only one specimen was obtained.

8. Catostomus commersonii (Lacépède). *Common Sucker.*

9. Catostomus nigricans (Le Sueur). *Hog Sucker.*

Both of these suckers are probably common.

10. Moxostoma aureolum (Le Sueur). *Common Redhorse.*
Probably common.

[**Cyprinus carpio** Linnæus. *German Carp.* This fish has been introduced into this lake and is said to be common.]

11. Campostoma anomalum (Rafinesque). *Stone-roller; "Chub."*
Abundant here, as it is everywhere in the Ohio Valley.

12. Pimephales notatus (Rafinesque). *Blunt-nosed Minnow; "Chub"; "White-nosed Chub."*
This minnow is abundant in the lake, and is one of the very best bait fishes. It is regarded as the best bait for the small-mouth black bass.

13. Semotilus atromaculatus (Mitchill). *Creek Chub; "Chub."*
The creek chub is common, particularly in the small streams tributary to the lake. It is an excellent bait minnow for the muskallunge.

14. Notropis cayuga Meek. *Cayuga Minnow.*
This interesting little minnow is not uncommon. It is usually too small for bait except for yellow perch.

15. Notropis hudsonius (De Witt Clinton). *Shiner; "Cisco."*
This important minnow, absurdly called "cisco" at Mayville, is common in Chautauqua Lake. It reaches a length of 3 to 6 inches, and is one of the very best bait minnows found in the State. It is a favorite minnow when trolling for the muskallunge, whose food is said to consist largely of this species.

16. Notropis whipplii (Girard). *Silver-fin; "Shiner."*
This minnow was found fairly common in Clear Creek near its mouth. It is one of the best bait minnows.

17. Notropis cornutus (Mitchill). *Redfin; "Shiner."*
Quite common in Clear Creek; an important bait minnow.

18. Rhinichthys atronasus (Mitchill). *Black-nosed Dace; "Creek Chub."*
Not uncommon in Clear Creek, most of the examples obtained being small.

19. Salvelinus fontinalis (Mitchill). *Brook Trout.*
The brook trout is said to occur in one or more of the small creeks on the east side of the lake.

20. Lucius ohiensis (Kirtland). *Chautauqua Muskallunge.*
The muskallunge is by all odds the most important fish found in Chautauqua Lake, whether considered from the standpoint of the angler or that of the commercial fisherman. It is very different in appearance from the muskallunge of the Great Lakes and apparently deserves to rank as a distinct species. The following color description was drawn up from a fresh example, 25 inches long, weighing 4 pounds, caught in the north end of the lake, near Mayville, September 26:

Back nearly uniform dark olive-green; upper two-thirds of side rich brassy green, with some metallic green; about 25 faint narrow darker vertical bars extending somewhat below the lateral line; lower third of side paler and more brassy, the 25 vertical bars widening into broad darkish blotches, these most greenish on posterior third of body; top of head very dark green; scaled part of head brassy greenish; lower part of side of head with less brassy and less greenish, and some silvery, especially on lower part of opercle; rim of lower jaw and throat white; breast with a few round greenish spots; rest of belly white; fins dark olive, with numerous darker greenish spots; iris grayish brown. The crossbars are rather broad and do not break up distinctly into diffuse spots, and the fin spots are greenish rather than black. The general color is a rich greenish brassy, with very indistinct darker green crossbars.

This species was described in 1854 by Dr. Kirtland from a specimen from the Mahoning River, Ohio. The real home of the fish, however, is Chautauqua Lake, only occasional individuals being taken elsewhere in the Ohio basin. As early as

1818 Rafinesque obtained it in the Ohio River. He says, "It is one of the best fishes in the Ohio; its flesh is very delicate and divides easily, as in salmon, into large plates as white as snow. It is called salmon pike, white pike, white jack, or white pickerel, and *picaneau blanc* by the Missourians. It reaches a length of 5 feet." It would appear from this that the muskallunge was a common, well-known fish in the Ohio a hundred years ago, even if we make some allowance for a possible misapplication by Rafinesque of some of the vernacular names.

Although abundant in Lake Chautauqua, it is of rare occurrence elsewhere in the Ohio basin, and it is not found naturally in any other. It is said to occur in Lake Conneaut, Pennsylvania; Kirtland got it in the Mahoning, and we have seen the head of a large example taken in the Ohio near Evansville.

For more than ten years the New York State Fish Commission has been propagating the Chautauqua muskallunge with signal success. The first attempt, which was in the nature of an experiment, was made in the spring of 1890, under the immediate direction of Mr. Munroe A. Green. Although the work was not begun until rather late in the spring, it resulted in the development of successful methods and the hatching of 75,000 fry, which were planted in the lake. This is believed to be the first successful attempt to hatch the muskallunge by artificial methods, and the work has been continued with increasing success every year since that date, as shown by the following tabular statement:

Year.	Number of fry hatched.	Number planted in Chautauqua Lake.	Number planted elsewhere
1890	75,000	75,000	----------
1891	1,750,000	1,750,000	----------
1892	1,360,000	1,260,000	100,000
1893	2,150,000	1,150,000	1,000,000
1894	2,970,000	1,970,000	1,000,000
1895	2,480,000	1,700,000	780,000
1896	1,815,000	1,000,000	815,000
1897	3,075,000	1,815,000	1,260,000
1898	2,650,000	900,000	1,750,000
Total	18,325,000	11,620,000	6,705,000

New York was the first State to undertake the hatching of the muskallunge artificially and is the only one that now does it except Wisconsin, and it has only been by this artificial propagation that the supply of these fish has been kept up. In about two years after this hatching was begun at Chautauqua there was a perceptible increase in the number of muskallunge taken by the fishermen. Since then the supply has kept about normal, and it is not now known that the number has increased or decreased in the past few years, but it is known that there is no better place in the world to fish for muskallunge than at Lake Chautauqua.

As a game fish the Chautauqua Lake muskallunge is by many held in very high esteem. Though it may not be a great game fish in the best sense, its size, which is often enormous, renders its capture and landing by means of hook and line an undertaking by no means devoid of exertion and interest. It is usually taken by trolling either with a spoon or good-sized minnow. At the time of our visit to this lake, the last week in September, the spoon seemed to be chiefly in use by the local anglers. A comparatively short line was used, and the boat was rowed only fast enough to keep the tackle in shape, the spoon being kept only a short distance under water. Later in the season, it was stated, minnows would be used. The "chub" (*Semotilus atromaculatus*) is the minnow most used early in the fall, but later, when the water becomes colder, the "shiner" (*Notropis cornutus*) is regarded as the better bait. The "cisco" (*Notropis hudsonius*) is also an excellent muskallunge bait and is said to constitute a considerable part of the regular food of that fish. The 4-pound example upon which the above color description was based had been feeding upon yellow perch, and one small example of that species was

found in its mouth. As a matter of fact, the muskallunge will doubtless feed upon almost any species of fish found in the lake.

As a food-fish the muskallunge is a superior fish. Dr. Kirtland says that "epicures consider it one of the best fishes of the West," and Mr. J. L. Beaman affirms that "as a food-fish there is nothing superior to it. It ranks with the salmon and speckled trout and surpasses the black and striped bass. The meat is almost as white as snow, fine-grained, nicely laminated, and the flavor is perfect." The quality of the meat seems to improve upon keeping. We ate choice pieces, that were fried, of an 8-pound muskallunge the day it was caught and found the meat white and flaky, but dry and with little or no flavor. Three days later we ate again of the same fish and found the meat decidedly more juicy and with a very pleasant flavor.

The muskallunge is as voracious as the pike, and 80 pounds of muskallunge represents several tons of minnows, white-fish, and the like. It is not a common fish; its great size and voracity perhaps account for this. As Charles Hallock has said, the muskallunge "is a long, slim, strong, and swift fish, in every way formed for the life it leads, that of a fierce and dauntless marauder."

21. Labidesthes sicculus (Cope). *Brook Silverside; Skipjack.*

Only two or three specimens of this interesting species were obtained, but it is doubtless abundant in the lake. At Lake Chautauqua we were assured that these fish were young muskallunge!

22. Ambloplites rupestris (Rafinesque). *"Rock Bass"; Red-eye; Goggle-eye.*

The rock bass is an abundant and well-known fish at this lake. On September 26 a number were taken with line and hook baited with grasshoppers, off the piers at Mayville. All seen were small.

23. Lepomis pallidus (Mitchill). *Bluegill; Blue Bream; Blue Sun-fish; Copper-nosed Bream; "Sun-fish."*

The bluegill is another abundant and well-known fish in this lake. It reaches a weight of one-half pound and is one of the best pan fishes.

24. Eupomotis gibbosus (Linnæus). *Common Sun-fish; "Pumpkin-seed."*

Apparently common, but less so than the bluegill.

25. Micropterus dolomieu Lacépède. *Small-mouthed Black Bass; "Yellow Bass."*

The small-mouthed black bass is doubtless the gamest fish in the lake. It does not appear to be very abundant. It is locally called "yellow bass," and is mentioned in the State law by the same absurd name. The name "yellow bass" is properly applied only to *Morone interrupta*, a very different fish, which is found in the Mississippi Valley and not in Chautauqua Lake.

26. Micropterus salmoides (Lacépède). *Large-mouthed Black Bass; Straw Bass; "Striped Bass."*

The large-mouthed black bass, known locally as "striped bass," is common in the lake and is an important game fish.

27. Perca flavescens (Mitchill). *Yellow Perch; "Perch."*

Apparently not common and not reaching the size it does in some other lakes.

28. Percina caprodes (Rafinesque). *"Sand Pike"; "Stone Pike."*

This darter is known locally as "sand pike" or "stone pike." It was found in considerable numbers in Clear Creek, near its mouth.

29. Etheostoma cœruleum Storer. *Blue Darter; Rainbow Darter; Soldier-fish.*

Only three examples of this beautiful darter were obtained.

30. Etheostoma flabellare Rafinesque. *Fan-tailed Darter.*

Several examples of this darter were obtained near the mouth of Clear Creek.

31. Cottus ictalops (Rafinesque). *Blob; Miller's Thumb.*

Not uncommon in Clear Creek. Called "devil-fish" or "flying-fish" by a local fisherman.

MOLLUSKS OF CHAUTAUQUA LAKE.

No special effort was made to collect the mollusks inhabiting this lake, and the following list is therefore far from complete. The little collecting that was done was on the northwest and north shores.

Species of *Unionidæ*, especially the heavy-shelled forms, do not appear to be very abundant, either as to species or individuals. *Campeloma*, *Planorbis*, *Limnæa*, and *Physa* seem abundant, and *Unio gibbosus*, *Anodonta grandis footiana*, and *Lampsilis luteolus* were the most common species of mussels. *Vivipara contectoides*, which is so abundant in many of the small lakes in northern Indiana in the Wabash Basin, was not found in Chautauqua Lake.

For assistance in the identification of the shells we are under obligations to Mr. Charles T. Simpson, of the Department of Mollusks, United States National Museum.

UNIVALVES.

1. *Campeloma decisum* Say. Common.
2. *Valvata tricarinata* Say. Only one specimen obtained.
3. *Planorbis trivolvis* Say.
4. *Planorbis campanulatus* Say.
5. *Planorbis bicarinatus* Say. Two specimens.
6. *Limnæa palustris* Müll. Common.
7. *Physa ancellaria* Say. Common.

BIVALVES.

8. *Sphærium rhomboideum* Prime.
9. *Sphærium striatinum* Lam.
10. *Sphærium sulcatum* Lam.

The second and third of the above three species were more common than the other.

11. *Anodonta grandis footiana* Lea.
12. *Unio gibbosus* Barnes.
13. *Lampsilis luteolus* (Lam.).
14. *Strophites undulatus* (Barnes).
15. *Strophites edentulus* (Say). This may be *Strophites undulatus*.

PUBLICATIONS OF THE UNITED STATES COMMISSION OF FISH AND FISHERIES AVAILABLE FOR DISTRIBUTION ON DECEMBER 1, 1901.

The publications of the Commission consist of an annual report and annual bulletin, which are Congressional documents; a certain number being allotted to Senators and Members of the House of Representatives, and a small quota assigned to the Commission. Each volume is made up of separate papers treating of the different subjects germane to the work of the Commission, and a small edition of these papers is issued in pamphlet form in advance of the bound volume for distribution to those specially interested in the subject-matter.

BOUND PUBLICATIONS.

Of the bound publications the earlier volumes are out of print and all the copies allowed this office have been distributed. A few copies of the following can be furnished:

Designation.	For the year—	Published.	Pages.	Plates.
Annual Reports:				
Part XV	1887	1891	LXIII+900	112
XVI	1888	1892	CXXVIII+902	90
XVII	1889-91	1894	664	67
XXV	1899	1900	CLXIII+397	XXIX+21
XXVI	1900	1901	1-570	1+VII
Annual Bulletin:				
Vol. XIX	1899	1901	VI+501	44+XXXIV

PAMPHLET PUBLICATIONS.

Each pamphlet has a serial number, which appears on the left in the accompanying list. The missing numbers are out of print and can not be supplied.

Serial No.

3. Report on the condition of the sea fisheries of the south coast of New England in 1871 and 1872, by Spencer F. Baird. Report for 1871-72, I, pp. I-XLI, 1873.
21. Cheap fixtures for hatching of salmon, by Charles G. Atkins. Report for 1878, VI, pp. 945-966 (including 15 figs.). 1880.
31. The winter haddock fishery of New England, by G. Brown Goode and J. W. Collins. Bulletin for 1881, I, pp. 226-235. 1882.
40. Popular extracts from the investigation of the Commission for the scientific examination of the German Seas, by H. A. Meyer et al. Report for 1879, VII, pp. 525-557 (including 17 figs.). 1882.
41. List of dredging stations of the U. S. Fish Commission from 1871 to 1879, inclusive, with temperature and other observations, by Sanderson Smith and Richard Rathbun. Report for 1879, VII, pp. 559-601. 1882.

Serial No.

62. Report of the Commissioner for 1880.—A. Inquiry into the decrease of food-fishes.—B. Propagation of food-fishes in the waters of the United States, by Spencer F. Baird. Report for 1880, VIII, pp. XVII–XLVI. 1883.
65. Report of the Commissioner for 1881, by Spencer F. Baird. Report for 1881, IX, pp. XIII–LXXI. 1884.
70. Report on the construction and work in 1880 of the Fish Commission steamer *Fish Hawk*, by Z. L. Tanner. Report for 1881, IX, pp. 3–53, plates I–XVIII, (including 3 figs.). 1884.
73. Annual report on the electric lighting of the U. S. F. C. steamer *Albatross*, December 31, 1883, by G. W. Baird. Bulletin for 1884, IV, pp. 153–158 (including 8 figs.). 1884.
75. The status of the U. S. Fish Commission in 1884, by G. Brown Goode. Report for 1884, XII, pp. 1139–1184. 1886.
130. Report on the work of the U. S. Fish Commission steamer *Albatross* for the year ending December 31, 1886, by Z. L. Tanner. Report for 1886, XIV, pp. 605–692, plates I–X. 1889.
131. Report of operations at the Wytheville Station, Va., from January 1, 1885, to June 30, 1887, by Marshall McDonald. Report for 1886, XIV, pp. 793–800, plates I–VI. 1889.
137. Suggestions for the employment of improved types of vessels in the market fisheries, with notes on British fishing steamers, by J. W. Collins. Bulletin for 1888, VIII, pp. 175–192, plates XVI–XXVII. 1890.
138. Notes on the fishes collected at Cozumel, Yucatan, by the U. S. Fish Commission, with descriptions of new species, by Tarleton H. Bean. Bulletin for 1888, VIII, pp. 193–206, plates XXVIII–XXIX. 1890.
141. A report upon the fishes of Kalamazoo, Calhoun, and Antrim counties, Mich., by Charles H. Bollman. Bulletin for 1888, VIII, pp. 219–225. 1891.
142. Notes on the fishes from the lowlands of Georgia, with a description of a new species (*Opsopœodus bollmani*), by Charles H. Gilbert. Bulletin for 1888, VIII, pp. 225–229. 1891.
145. Report on the proposed introduction of the Jamaica mountain mullet into the United States, by Tarleton H. Bean. Bulletin for 1888, VIII, pp. 443–451. 1891.
146. The transplanting of lobsters to the Pacific coast of the United States, by Richard Rathbun. Bulletin for 1888, VIII, pp. 453–472, plate LXXI. 1891.
147. Preliminary report on the invertebrate animals inhabiting Lakes Geneva and Mendota, Wisconsin, with an account of the fish epidemic in Lake Mendota in 1884, by S. A. Forbes. Bulletin for 1888, VIII, pp. 473–487, plates LXXII–LXXIV. 1890.
151. The artificial propagation of sturgeon in Schleswig-Holstein, Germany. Bulletin for 1889, IX, pp. 81–90. 1891.
163. The giant-scallop fishery of Maine, by Hugh M. Smith. Bulletin for 1889, IX, pp. 313–335, plates CXII–CXVI. 1891.
165. Notice of the occurrence of protozoan parasites (psorosperms) on cyprinoid fishes in Ohio, by Edwin Linton. Bulletin for 1889, IX, pp. 359–361, plate CXX. 1891.
166. Notes on the king-crab fishery of Delaware Bay, by Hugh M. Smith. Bulletin for 1889, IX, pp. 363–370, plates CXXI–CXXIII. 1891.
167. Report upon a collection of fishes made in southern Florida during 1889, by James A. Henshall. Bulletin for 1889, IX, pp. 371–389. 1891.
171. Report upon the construction and equipment of the schooner *Grampus*, by J. W. Collins. Report for 1887, XV, pp. 437–490 (including 5 figs.), plates I–XVIII. 1891.
172. Report of the operations of the U. S. Fish Commission schooner *Grampus* from March 15, 1887, to June 30, 1888, by J. W. Collins and D. E. Collins. Report for 1887, XV, pp. 491–598, plates I–XVI. 1891.
174. On some Lake Superior entomostraca, by S. C. Forbes. Report for 1887, XV, pp. 701–718, plates I–IV. 1891.
179. Report of distribution of fish and eggs from July 1, 1888, to June 30, 1889. Report for 1888, XVI, pp. 379–394. 1892.
181. Report of operations at the laboratory of the U. S. Fish Commission, Woods Hole, Mass., during the summer of 1888, by John A. Ryder. Report for 1888, XVI, pp. 513–522. 1892.
182. Notes on entozoa of marine fishes, with description of new species, part III, by Edwin Linton. Report for 1888, XVI, pp. 523–542, plates LIII–LX. 1892.
183. On the anatomy of *Thysanocephalum crispum* Linton, a parasite of the tiger shark, by Edwin Linton. Report for 1888, XVI, pp. 543–556, plates LXI–LXVII. 1892.

Serial No.

186. Observations on the aquaria of the U. S. Fish Commission at Central Station, Washington, D. C., by William P. Seal. Bulletin for 1890, X, pp. 1-12 (including 2 figs.), plates I-IV. 1892.
188. Observations upon fishes and fish-culture, by Tarleton H. Bean. Bulletin for 1890, X, pp. 49-61. 1892.
189. Notes on a collection of fishes from the lower Potomac River, by Hugh M. Smith. Bulletin for 1890, X, pp. 63-72, plates XVIII-XX. 1892.
191. Report upon the participation of the U. S. Fish Commission in the Centennial Exposition held at Cincinnati, Ohio, in 1888, by J. W. Collins. Report for 1888, XVI, pp. 869-885, plate XC. 1892.
192. Report of the Commissioner for 1888 [July 1, 1888, to June 30, 1889], including the reports on the division of fish-culture, scientific inquiry, and fisheries, by Marshall McDonald. Report for 1888, XVI, pp. IX-CXXVIII. 1892.
194. Report on an investigation of the fisheries of Lake Ontario, by Hugh M. Smith. Bulletin for 1890, X, pp. 177-215, plates XXI-L. 1892.
195. A report upon the fisheries of Iowa, based upon observations and collections made during 1889, 1890, and 1891, by Seth E. Meek. Bulletin for 1890, X, pp. 217-248. 1892.
196. Report of an examination of the rivers of Kentucky, with lists of the fishes obtained, by Albert J. Woolman. Bulletin for 1890, X, pp. 249-288, plate L. 1892.
197. Notes on the streams and fishes of Clinton County, Ky., with a description of a new darter, by Philip H. Kirsch. Bulletin for 1890, X, pp. 289-292 (including 1 fig.). 1892.
198. Report upon the rivers of central Florida tributary to the Gulf of Mexico, with lists of fishes inhabiting them, by Albert J. Woolman. Bulletin for 1890, X, pp. 293-302, plates LII-LIII. 1892.
201. Observations on the hatching of the yellow perch, by S. G. Worth. Bulletin for 1890, X, pp. 331-334, plate LXI. 1892.
202. The physical and biological characteristics of the natural oyster-grounds of South Carolina, by Bashford Dean. Bulletin for 1890, X, pp. 335-361, plates LXII-LXVIII. 1892.
203. The present methods of oyster-culture in France, by Bashford Dean. Bulletin for 1890, X, pp. 363-388 (including 2 figs.), plates LXIX-LXXVIII. 1892.
207. Description of a new sucker, *Pantosteus jordani*, from the Upper Missouri Basin, by Barton W. Evermann. Bulletin for 1892, XII, pp. 51-56 (including 1 fig.). 1893.
211. Notes on a collection of fishes from the southern tributaries of the Cumberland River in Kentucky and Tennessee, by Philip H. Kirsch. Bulletin for 1891, XI, pp. 259-267. 1893.
212. Report on the fisheries of the South Atlantic States, by Hugh M. Smith. Bulletin for 1891, XI, pp. 271-356, plates XLIII-LXXIV. 1893.
214. Report upon the European methods of oyster-culture, by Bashford Dean. Bulletin for 1891, XI, pp. 357-406 (including 2 figs.), plates LXXV-LXXXVIII. 1893.
215. On the classification of the Myxosporidia, a group of protozoan parasites infesting fishes, by R. R. Gurley. Bulletin for 1891, XI, pp. 407-420. 1893.
217. Report of observations respecting the oyster resources and oyster fishery of the Pacific coast of the United States, by C. H. Townsend. Report for 1889-1891, XVII, pp. 343-372, plates 3-12. 1892.
218. Report on the coast fisheries of Texas, by Charles H. Stevenson. Report for 1889-1891, XVII, pp. 373-420, plates 13-27. 1893.
222. Natural history of the useful aquatic reptiles and batrachians of the United States, by Frederick W. True. The Fisheries and Fishery Industries of the United States, sec. I, pp. 141-162. 1884.
223. Natural history of mollusks in general, by Ernest Ingersoll. The Fisheries and Fishery Industries of the United States, sec. I, pp. 687-710, plates 253-258. 1884.
224. Natural history of crustaceans, worms, radiates, and sponges, by Richard Rathbun. The Fisheries and Fishery Industries of the United States, sec. I, pp. 763-850, plates 260-277. 1884.
226. The fyke-nets and fyke-net fisheries of the United States, with notes on the fyke-nets of other countries, by Hugh M. Smith. Bulletin for 1892, XII, pp. 299-356, plates LXXII-XCI. 1894.
229. List of fishes collected at Sea Isle City, N. J., during the summer of 1892, by H. F. Moore. Bulletin for 1892, XII, pp. 357-380. 1894.
230. Economic and natural-history notes on fishes of the northern coast of New Jersey, by Hugh M. Smith. Bulletin for 1892, XII, pp. 365-380. 1894.

Serial No.

232. Notes on two hitherto unrecognized species of American white-fishes, by Hugh M. Smith. Bulletin for 1894, XIV, pp. 1–13, plate 1. 1894.
233. Extension of the recorded range of certain marine and fresh-water fishes of the Atlantic coast of the United States, by W. C. Kendall and Hugh M. Smith. Bulletin for 1894, XIV, pp. 15–21. 1894.
235. Report upon explorations made in Eel River Basin, in the northeastern part of Indiana, in the summer of 1892, by Philip H. Kirsch. Bulletin for 1894, XIV, pp. 31–41. 1894.
236. Notes on the fresh-water fishes of Washington County, Me., by William C. Kendall. Bulletin for 1894, XIV, pp. 43–54. 1894.
237. World's Fisheries Congress. Report of the secretary of the general committee, by Tarleton H. Bean. Bulletin for 1893, XIII, pp. 1–14. 1894.
240. The sea and coast fisheries, by Daniel T. Church. Bulletin for 1893, XIII, pp. 37–38. 1894.
241. Our ocean fishes and the effect of legislation upon the fisheries, by J. M. K. Southwick. Bulletin for 1893, XIII, pp. 39–45. 1894.
243. The relation of scientific research to economic problems, by G. Brown Goode. Bulletin for 1893, XIII, pp. 49–58. 1894.
246. The investigation of rivers and lakes with reference to fish environment, by B. W. Evermann. Bulletin for 1893, XIII, pp. 69–73. 1894.
247. The habits and development of the lobster, and their bearing on its artificial propagation, by Francis H. Herrick. Bulletin for 1893, XIII, pp. 75–86. 1894.
250. Some observations concerning fish parasites, by Edwin Linton. Bulletin for 1893, XIII, pp. 101–126, plates 1–8. 1894.
251. On the food of the menhaden, by James I. Peck. Bulletin for 1893, XIII, pp. 113–126, plates 1–8. 1894.
252. Some plankton studies in the Great Lakes, by Jacob E. Reighard. Bulletin for 1893, XIII, pp. 127–142, plates 9, 10. 1894.
253. The aquarium of the U. S. Fish Commission at the World's Columbian Exposition, by S. A. Forbes. Bulletin for 1893, XIII, pp. 143–158. 1894.
253. Description of the fresh and salt water supply and pumping plants used for the aquarium, by I. S. K. Reeves. Bulletin for 1893, XIII, pp. 159–161. 1894.
253. Observations and experiments on Saprolegnia infesting fish, by G. P. Clinton. Bulletin for 1893, XIII, pp. 163–172. 1894.
253. Report on a parasitic protozoan observed on fish in the aquarium, by Charles Wardell Stiles. Bulletin for 1893, XIII, pp. 173–190, plates 11, 12. 1894.
257. History and methods of white-fish culture, by Frank N. Clark. Bulletin for 1893, XIII, pp. 213–220. 1894.
260. Fish and fishing in British Guiana, by J. J. Quelch. Bulletin for 1893, XIII, pp. 237–240. 1894.
261. Fish-cultural investigations at St. Andrews Marine Laboratory, Scotland, by W. C. McIntosh. Bulletin for 1893, XIII, pp. 241–256. 1894.
261. Description of the marine hatchery at Dunbar, Scotland, by T. Wemyss Fulton. Bulletin for 1893, XIII, pp. 257–262. 1894.
262. The past, present, and future of the oyster industry of Georgia, by A. Oemler. Bulletin for 1893, XIII, pp. 263–272. 1894.
263. Deep-water oyster-culture, by Henry C. Rowe. Bulletin for 1893, XIII, pp. 273–276. 1894.
264. Breeding natural food artificially for young fish artificially hatched, by A. Nelson Cheney. Bulletin for 1893, XIII, pp. 277–279. 1894.
269. Recent experiments in sturgeon hatching on the Delaware River, by Bashford Dean. Bulletin for 1893, XIII, pp. 335–339 (including 1 fig.). 1894.
270. The fisheries of Canada, by L. Z. Joncas. Bulletin for 1893, XIII, pp. 341–348. 1894.
271. The fishing industry of Lake Erie, past and present, by C. M. Keyes. Bulletin for 1893, XIII, pp. 349–353. 1894.
272. Notes on the Irish mackerel fisheries, by William Spotswood Green. Bulletin for 1893, XIII, pp. 357–360, plates 13–16. 1894.
275. Fish nets: Some account of their construction and the application of the various forms in American fisheries, by C. H. Augur. Bulletin for 1893, XIII, pp. 381–388. 1894.
278. On pearls, and the utilization and application of the shells in which they are found, in the ornamental arts, as shown at the World's Columbian Exposition, by George Frederick Kunz. Bulletin for 1893, XIII, pp. 439–457, plates 18–41. 1894.
279. Report on a collection of fishes from the rivers of central and northern Mexico, by Albert J. Woolman. Bulletin for 1894, XIV, pp. 55–66, plate 2. 1894.

Serial No.

282. Results of explorations in western Canada and northwestern United States, by C. H. Eigenmann. Bulletin 1894, XIV, pp. 101–131, plates 5–8. 1894.
283. Report of the Commissioner for the fiscal year ending June 30, 1892, including the reports on the divisions of scientific inquiry and fisheries, by Marshall McDonald. Report for 1892, XVIII, pp. VII–CCIV. 1894.
284. Report upon the investigations of the U. S. Fish Commission steamer *Albatross* for the year ending June 30, 1892, by Z. L Tanner. Report for 1892, XVIII, pp. 1–64, plate A. 1894.
288. Notes on the fishes of western Iowa and eastern Nebraska, by Seth E. Meek. Bulletin for 1894, XIV, pp. 133–138. 1894.
288. List of fishes inhabiting Clear Lake, California, by David S. Jordan and Charles H. Gilbert. Bulletin for 1894, XIV, pp. 139–140. 1894.
288. Notes on the fresh-water species of San Luis Obispo County, Cal., by David S. Jordan. Bulletin for 1894, XIV, pp. 141–142. 1894.
290. The salmon fisheries of Columbia River, together with a report upon physical and natural history investigations in the region by C. H. Gilbert and B. W. Evermann, by Marshall McDonald. Bulletin for 1894, XIV, pp. 153–168, plates 13–15. 1894.
292. Notes on fishes collected in Florida in 1892, by James A. Henshall. Bulletin for 1894, XIV, pp. 209–221. 1894.
293. Notes on a reconnaissance of the fisheries of the Pacific coast of the United States in 1894, by Hugh M. Smith. Bulletin for 1894, XIV, pp. 223–288. 1894.
294. Feeding and rearing of fishes, particularly trout, under domestication, by William F. Page. Bulletin for 1894, XIV, pp. 289–314. 1895.
295. Report upon the investigations in the Maumee River Basin during the summer of 1893, by Philip H. Kirsch. Bulletin for 1894, XIV, pp. 315–337. 1895.
296. A statistical report on the fisheries of the Middle Atlantic States, by Hugh M. Smith. Bulletin for 1894, XIV, pp. 339–467. 1895.
297. The fishes of the Colorado Basin, by Barton W. Evermann and Cloud. Rutter. Bulletin for 1894, XIV, 473–486. 1895.
297. A list of species of fishes known from the vicinity of Neosho, Mo., by Barton W. Evermann and W. C. Kendall. Bulletin for 1894, XIV, pp. 469–472. 1895.
298. Report of the Commissioner for the fiscal year ending June 30, 1893, including the reports on divisions of fish-culture, scientific inquiry, and fisheries, by Marshall McDonald. Report for 1893, XIX, pp. 1–138. 1896.
301. A preliminary report upon salmon investigations in Idaho in 1894, by Barton W. Evermann. Bulletin for 1895, XV, pp. 253–284. 1896.
302. Notes on an investigation of the menhaden fishery in 1894, with special reference to the food-fishes taken, by Hugh M. Smith. Bulletin for 1895, XV, pp. 285–302. 1896.
303. The fishes of the Neuse River Basin, by Barton W. Evermann and Ulysses O. Cox. Bulletin for 1895, XV, pp. 303–310. 1896.
304. Notes on intensive pond culture at Sandfort, by S. Jaffé. Bulletin for 1895, XV, pp. 311–316. 1896.
304. Notes on the rearing of yearling trout at Sandfort, by S. Jaffé. Bulletin for 1895, XV, pp. 317–319. 1896.
304. Fish-cultural methods at the Agricultural School at Freising. Anonymous. Bulletin for 1895, XV, pp. 320–321, plate 55. 1896.
304. The course of instruction of the Bavarian Fishery Association. Anonymous. Bulletin for 1895, XV, pp. 321–324. 1896.
305. Report on a reconnaissance of the oyster-beds of Mobile Bay and Mississippi Sound, Alabama, by Homer P. Ritter. Bulletin for 1895, XV, pp. 325–339, plates 56–63. 1896.
306. A list of fishes and mollusks collected in Arkansas and Indian Territory in 1894, by Seth Eugene Meek. Bulletin for 1895, XV, pp. 341–349. 1896.
307. The sources of marine food, by James I. Peck. Bulletin for 1895, XV, pp. 351–368. 1896, plates 64–71. 1896.
308. Contributions toward the improvement of the culture of salmonoids and crawfish in small water-courses, by Karl Wozelka-Iglau. Bulletin for 1895, XV, pp. 369–378, plate 72. 1896.
309. A review of the history and results of the attempt to acclimatize fish and other water animals in the Pacific States, by Hugh M. Smith. Bulletin for 1895, XV, pp. 379–472, plates 73–83. 1896.
310. Report upon the work of the U. S. Fish Commission steamer *Albatross* for the year ending June 30, 1893, by Z. L. Tanner. Report for 1893, XIX, pp. 305–341, plates 15–18. 1896.

Serial No.

311. Report of the representative of the U. S. Fish Commission at the World's Columbian Exposition, by Tarleton H. Bean. Report for 1894, XX, pp. 177–196, plates 1–5. 1896.
312. Report upon ichthyological investigations in western Minnesota and eastern North Dakota, by Albert J. Woolman. Report for 1893, XIX, pp. 343–373, plate 19. 1896.
313. The food of the oyster, clam, and ribbed mussel, by John P. Lotsy. Report for 1893, XIX, pp. 375–386 (including 4 figs.). 1896.
314. Establishment of stations for the propagation of salmon on the Pacific coast, by John J. Brice. Report for 1893, XIX, pp. 387–392. 1896.
316. The Russian fur-seal islands, by Leonard Stejneger. Bulletin for 1896, XVI, pp. 1–148, plates 1–66. 1896.
317. Remarks on the movements and breeding grounds of the fur-seal, based on observations made while on the United States naval patrol of Bering Sea in 1894, by John J. Brice. Report for 1894, XX, pp. 573–577. 1896.
318. A report upon salmon investigations in the headwaters of the Columbia River, in the State of Idaho, in 1895; together with notes upon the fishes observed in that State in 1894 and 1895, by Barton W. Evermann. Bulletin for 1896, XVI, pp. 149–202, plates 67–72. 1896.
319. The artificial propagation of the rainbow trout, by George A. Seagle. Bulletin for 1896, XVI, pp. 237–256, plates 88–94. 1896.
320. The artificial propagation of salmon on the Pacific coast of the United States, with notes on the natural history of the quinnat salmon, by Livingston Stone. Bulletin for 1896, XVI, pp. 203–235, plates 73–87. 1896.
321. Report upon the operations of the U. S. Fish Commission steamer *Albatross* for the year ending June 30, 1894, by Z. L. Tanner and F. J. Drake. Report for 1894, XX, pp. 197–278, plates 6–8. 1896.
322. Description of a closing tow net for submarine use at all depths, by C. H. Townsend. Report for 1894, XX, pp. 279–282; plates 9, 10. 1896.
323. The whitefishes of North America, by Barton W. Evermann and Hugh M. Smith. Report for 1894, XX, pp. 283–324, plates 11–28. 1896.
324. A report upon the fishes of the Missouri River Basin, by Barton W. Evermann and Ulysses O. Cox. Report for 1894, XX, pp. 325–429. 1896.
325. A review of the foreign fishery trade of the United States, by Charles H. Stevenson. Report for 1894, XX, pp. 431–571. 1896.
326. The ichthyological collections of the U. S. Fish Commission steamer *Albatross* during the years 1890 and 1891, by Charles H. Gilbert. Report for 1893, XIX, pp. 393–476, plates 20–35. 1896.
327. An annotated catalogue of the fishes known from the State of Vermont, by Barton W. Evermann and W. C. Kendall. Report for 1894, XX, pp. 579–604.
328. A report upon the fishes of southwestern Minnesota, by Ulysses O. Cox. Report for 1894, XX, pp. 605–616. 1896.
329. List of publications of the U. S. Commission of Fish and Fisheries from its establishment, in 1871, to February, 1896, by Charles W. Scudder. Report for 1894, XX, pp. 617–706. 1896.
331. Report of the Commissioner for the fiscal year ending June 30, 1895, including the reports on the divisions of fish-culture, scientific inquiry, and fisheries, by Marshall McDonald. Report for 1895, XXI, pp. 1–123. 1896.
332. Report upon the investigations of the U. S. Fish Commission steamer *Albatross* for the year ending June 30, 1895 (abstract), by F. J. Drake. Report for 1895, XXI, pp. 125–168. 1896.
333. Notes on Biscayne Bay, Florida, with reference to its adaptability as the site of a marine hatching and experiment station, by Hugh M. Smith. Report for 1895, XXI, pp. 169–191. 1896.
334. The transplanting of eastern oysters to Willapa Bay, Washington, with notes on the native oyster industry, by C. H. Townsend. Report for 1895, XXI, pp. 193–202, plate 1. 1896.
335. Description of a new species of shad (*Alosa alabamæ*) from Alabama, by Barton W. Evermann. Report for 1895, XXI, pp. 203–205. 1896.
336. A check-list of the fishes and fish-like vertebrates of North and Middle America, by David Starr Jordan and Barton Warren Evermann. Report for 1895, XXI, pp. 207–584. 1896.
338. Report of the representatives of the U. S. Fish Commission at the Cotton States and International Exposition at Atlanta, Ga., in 1895, by W. de C. Ravenel. Report for 1896, XXII, pp. 147–167 (including 3 figs.), plates 11–21. 1897.
339. Notes on the extension of the recorded range of certain fishes of the United States coast, by Hugh M. Smith and William C. Kendall. Report for 1896, XXII, pp. 169–176. 1897.

Serial No.

340. Notes on the food of four species of the cod family, by William C. Kendall. Report for 1896, XXII, pp. 177–186. 1897.
341. The fisheries of Indian River, Florida, by John J. Brice et al. Report for 1896, XXII, pp. 223–262, plates 22–60. 1897.
342. Report on the fish and fisheries of the coastal waters of Florida, by John J. Brice. Report for 1896, XXII, pp. 263–342. 1897.
343. Report of a survey of the oyster regions of St. Vincent Sound, Apalachicola Bay, and St. George Sound, Florida, by Franklin Swift. Report for 1896, XXII, pp. 187–221, plate 21. 1897.
344. Report of the Commissioner for the fiscal year ending June 30, 1897, including the reports on divisions of fish-culture, scientific inquiry, and fisheries, by John J. Brice. Report for 1897, XXIII, pp. I–CLXXI. 1898.
345. A manual of fish-culture, based on the methods of the U. S. Commission of Fish and Fisheries, with chapters on the cultivation of oysters and frogs. Report for 1897, pp. 1–340, plates. Frontispiece, +1 to 64+I–XVIII. Revised edition, 1900.
346. Artificial propagation of the Atlantic salmon, rainbow trout, and brook trout. Report for 1897, XXIII, pp. 17–90 (including 14 figures), plates 11–29. 1897.
347. Artificial propagation of the black bass, crappies, and rock bass. Report for 1897, XXIII, pp. 147–163 (including 2 figures), plates 47–50. 1897. Revised edition, 1900.
348. Notes on the edible frogs of the United States and their artificial propagation, by F. M. Chamberlain. Report for 1897, XXIII, pp. 249–261 (including 6 figures). 1897.
349. Oysters and methods of oyster-culture, with notes on clam-culture, by H. F. Moore. Report for 1897, XXIII, pp. 263–340 (including 6 figures), plates I–XVIII. 1897.
351. The fishes of the Klamath River Basin, by Charles H. Gilbert. Bulletin for 1897, XVII, pp. 1–13 (including 6 figures). 1898.
352. A report on salmon investigations in the Columbia River Basin and elsewhere on the Pacific coast in 1896, by Barton W. Evermann and Seth Eugene Meek. Bulletin for 1897, XVII, pp. 15–84 (including 6 figures), plates 1 and 2. 1898.
353. The fishes found in the vicinity of Woods Hole, by Hugh M. Smith. Bulletin 1897, XVII, pp. 85–111 (including 1 figure), plate 3. 1898.
355. Report of observations made on board the U. S. Fish Commission steamer *Albatross* during the year ending June 30, 1896. Report for 1896, XXII, pp. 357–386. 1897.
356. Observations upon the herring and herring fisheries of the northeast coast, with special reference to the vicinity of Passamaquoddy Bay, by H. F. Moore, Ph. D. Report for 1896, XXII, pp. 387–442, plates 60–62. 1897.
357. The salmon fishery of Penobscot Bay and River in 1895 and 1896, by Hugh M. Smith. Bulletin for 1897, XVII, pp. 113–124, plates 4 and 5. 1898.
358. Descriptions of new or little-known genera and species of fishes from the United States, by Barton W. Evermann and William C. Kendall. Bulletin for 1897, XVII, pp. 125–133, plates 6–9. 1898.
359. Notes on the halibut fishery of the northwest coast in 1896, by A. B. Alexander. Bulletin for 1897, XVII, pp. 141–144. 1898.
360. The herring industry of the Passamaquoddy region, Maine, by Ansley Hall. Report for 1896, XXII, pp. 443–489. 1897.
361. Statistics of the fisheries of the interior waters of the United States, by Hugh M. Smith. Report for 1896, XXII, pp. 489–574. 1898.
362. Notes on the fisheries of the Pacific coast in 1895, by William A. Wilcox. Report for 1896, XXII, pp. 575–659. 1898.
363. Proceedings and papers of the National Fishery Congress. Bulletin for 1897, XVII, pp. 145–371. 1898.
364. Proceedings of National Fishery Congress. Bulletin for 1897, XVII, pp. 147–168. 1898.
365. Methods of plankton investigation in their relation to practical problems, by Jacob Reighard. Bulletin for 1897, XVII, pp. 169–175. 1898.
366. The importance of extended scientific investigation, by H. C. Bumpus. Bulletin for 1897, XVII, pp. 177–180. 1898.
367. The utility of a biological station on the Florida coast in its relations to the commercial fisheries, by S. E. Meek. Bulletin 1897, XVII, pp. 181–183. 1898.
368. Establishment of a biological station on the Gulf coast, by W. Edgar Taylor. Bulletin for 1897, XVII, pp. 185–188. 1898.
369. Some notes on American shipworms, by Charles P. Sigerfoos. Bulletin for 1897, XVII, pp. 189–191. 1898.

Serial No.

370. An economical consideration of fish parasites, by Edwin Linton. Bulletin for 1897, XVII, pp. 193–199. 1898.
371. The fish fauna of Florida, by B. W. Evermann. Bulletin for 1897, XVII, pp. 201–208. 1898.
372. The lampreys of central New York, by H. A. Surface. Bulletin for 1897, XVII, pp. 209–215, plates 10 and 11. 1898.
373. The protection of the lobster fishery, by Francis H. Herrick. Bulletin for 1897, XVII, pp. 217–224. 1898.
374. The Florida commercial sponges, by Hugh M. Smith. Bulletin for 1897, XVII, pp. 225–240, plates 12–31. 1898.
375. On the feasibility of raising sponges from the egg, by H. V. Wilson. Bulletin for 1897, XVII, pp. 241–245. 1898.
376. The Hudson River as a salmon stream, by A. Nelson Cheney. Bulletin for 1897, XVII, pp. 247–251. 1898.
377. A plea for the development and protection of Florida fish and fisheries, by James A. Henshall. Bulletin for 1897, XVII, pp. 253–255. 1898.
378. International protection for the denizens of the sea and waterways, by Bushrod W. James. Bulletin for 1897, XVII, pp. 257–263. 1898.
379. The restricted inland range of shad due to artificial obstructions, and its effect upon natural reproduction, by Charles H. Stevenson. Bulletin for 1897, XVII, pp. 265–271. 1898.
380. The green turtle and the possibilities of its protection and consequent increase on the Florida coast, by Ralph M. Munroe. Bulletin for 1897, XVII, pp. 273–274. 1898.
381. Some factors in the oyster problem, by H. F. Moore. Bulletin for 1897, XVII, pp. 275–284. 1898.
382. The oyster grounds of the west Florida coast; their extent, condition, and peculiarities, by Franklin Swift. Bulletin for 1897, XVII, pp. 285–287. 1898.
383. The oyster and oyster beds of Florida, by John G. Ruge. Bulletin for 1897, XVII, pp. 289–296. 1898.
384. The Louisiana oyster industry, by F. C. Zacharie. Bulletin for 1897, XVII, pp. 297–304. 1898.
385. The oyster bars of the west coast of Florida, their depletion and restoration, by H. A. Smeltz. Bulletin for 1897, XVII, pp. 305–308. 1898.
386. Notes on the fishing industry of eastern Florida, by John Y. Detwiler. Bulletin for 1897, XVII, pp. 309–312. 1898.
387. Oysters and oyster culture in Texas, by I. P. Kibbe Bulletin for 1897, XVII, pp. 313–314. 1898.
388. The methods, limitations, and results of white-fish culture in Lake Erie, by J. J. Stranahan. Bulletin for 1897, XVII, pp. 315–319. 1898.
389. A brief history of the gathering of fresh-water pearls in the United States, by George F. Kunz. Bulletin for 1897, XVII, pp. 321–330. 1898.
390. The red-snapper fisheries; their past, present, and future, by Andrew F. Warren. Bulletin for 1897, XVII, pp. 331–335. 1898.
391. Some brief reminiscences of the early days of fish-culture in the United States, by Livingston Stone. Bulletin for 1897, XVII, pp. 337–343. 1898.
392. The relations between State fish commissions and commercial fishermen, by W. E. Meehan. Bulletin for 1897, XVII, pp. 345–348. 1898.
393. Possibilities for an increased development of Florida's fishery resources, by John N. Cobb. Bulletin for 1897, XVII, pp. 349–351. 1898.
394. The utility and methods of mackerel propagation, by J. Percy Moore. Bulletin for 1897, XVII, pp. 353–361. 1898.
395. The large-mouthed black bass in Utah, by John Sharp. Bulletin for 1897, XVII, pp. 363–368. 1898.
396. Florida fur farming, by J. M. Willson, jr. Bulletin for 1897, XVII, pp. 369–371. 1898.
397. The fresh-water pearls and pearl fisheries of the United States, by George F. Kunz. Bulletin for 1897, XVII, pp. 373–426, plates I–XXII.
399. Report on mackerel investigations in 1897, by J. Percy Moore. Report for 1898, XXIV, pp. 1–22. 1899.
400. Reports on fishes obtained by the steamer *Albatross* in the vicinity of Santa Catalina island and Monterey Bay, by Charles H. Gilbert. Report for 1898, XXIV, pp. 23–29, plates 1 and 2. 1899.
401. Notes on the extent and condition of the alewife fisheries of the United States in 1896, by Hugh M. Smith. Report for 1898, XXIV, pp. 31–43. 1899.
402. Report on the oyster beds of Louisiana, by H. F. Moore. Report for 1898, XXIV, pp. 45–100, plate 3. 1899.

Serial No.

403. The shad fisheries of the Atlantic coast of the United States, by Charles H. Stevenson. Report for 1898, XXIV, pp. 101–269. 1899.
404. List of fishes collected at the Revillagigedo Archipelago and neighboring islands, by David Starr Jordan and Richard Crittenden McGregor. Report for 1898, XXIV, pp. 273–284, plates 4–7. 1899.
405. Report on investigations by the U. S. Fish Commission in Mississippi, Louisiana, and Texas in 1897, by Barton Warren Evermann. Report for 1898, XXIV, pp. 285–310, plates 8–36. 1899.
406. List of publications of the U. S. Commission of Fish and Fisheries available for distribution on March 1, 1899. Report for 1898, XXIV, pp. 311–327. 1899.
407. Report upon exhibit of the U. S. Fish Commission at the Tennessee Centennial Exposition in 1897, by W. de C. Ravenel. Report for 1898, XXIV, pp. 329–339, plate 37. 1899.
409. List of fishes known to inhabit the waters of the District of Columbia and vicinity, by Hugh M. Smith and Barton A. Bean. Bulletin for 1898, pp. 179 to 187. 1899.
410. Notes on a collection of tide-pool fishes from Kadiak Island in Alaska, by Cloudsley Rutter. Bulletin for 1898, pp. 189 to 192. 1899.
411. The southern spring mackerel fishery of the United States, by Hugh M. Smith. Bulletin for 1898, pp. 193 to 271. 1899.
412. Notice of file-fish new to the fauna of the United States, by Hugh M. Smith. Bulletin for 1898, pp. 273 to 278, plate 64. 1899.
413. The pearly fresh-water mussels of the United States, their habits, enemies, and diseases, with suggestions for their protection, by Charles T. Simpson. Bulletin for 1898, pp. 279 to 288. 1899.
414. The mussel fishery and pearl-button industry of the Mississippi River, by Hugh M. Smith. Bulletin for 1898, pp. 289 to 314, plates 65 to 85. 1899.
415. The peripheral nervous system of the bony fishes, by C. Judson Herrick. Bulletin for 1898, pp. 315 to 320. 1899.
416. The reappearance of the tile-fish, by Hermon C. Bumpus. Bulletin for 1898, pp. 321 to 333. 1899.
417. The preservation of fishery products for food, by Charles H. Stevenson. Bulletin for 1898, pp. 335 to 563, plates I to XLIII. 1899.
419. Check list of the fishes of Florida, by Barton Warren Evermann and William Converse Kendall. Report for 1899, pp. 35 to 103. 1899.
420. Statistics of the fisheries of the Gulf States, by division of statistics, C. H. Townsend, assistant in charge. Report for 1899, pp. 105 to 169. 1899.
421. Statistics of the fisheries of the South Atlantic States by division of statistics, C. H. Townsend, assistant in charge. Report for 1899, pp. 171 to 227. 1899.
422. An inquiry into the feasibility of introducing useful marine animals into the waters of Great Salt Lake, by H. F. Moore. Report for 1899, pp. 229 to 250, plate 7. 1899.
423. A review of the fisheries in the contiguous waters of the State of Washington and British Columbia, by Richard Rathbun. Report for 1899, pp. 251 to 350, plates 8 to 16. 1899.
424. Experiments in photography of live fishes, by R. W. Shufeldt. Bulletin for 1899, pp. 1 to 5, plates 1 to 9. 1899.
425. Notes on the tide-pool fishes of California, with a description of four new species, by Arthur White Greeley. Bulletin for 1899, pp. 7 to 20. 1899.
426. The synaptas of the New England coast, by Hubert Lyman Clark. Bulletin for 1899, pp. 21 to 31, plates 10 and 11. 1899.
427. Descriptions of new genera and species of fishes from Porto Rico, by Barton Warren Evermann and Millard Caleb Marsh. Report for 1899, pp. 351 to 362. 1899.
428. Descriptions of two new species of darters from Lake Maxinkuckee, Indiana, by Barton Warren Evermann. Report for 1899, pp. 363 to 367. 1900.
429. The sturgeon fishery of Delaware River and Bay, by John N. Cobb. Report for 1899, pp. 369 to 380, plates 18 to 21. 1900.
430. Report of the Commissioner for the fiscal year ending June 30, 1899, including the reports of division of fish culture, scientific inquiry, and fisheries, by George M. Bowers. Report for 1899, pp. VII to CLXIII, plates I to XXIX. 1900.
431. The gas-bubble disease of fish, and its cause, by F. P. Gorham. Bulletin for 1899, pp. 33 to 37, plate 12. 1900.
432. The clam problem and clam culture, by James L. Kellogg. Bulletin for 1899, pp. 39 to 44, plate 13. 1900.

Serial No.

433. Descriptions of new species of fishes from the Hawaiian Islands, belonging to the families of Labridæ and Scaridæ, by Oliver P. Jenkins. Bulletin for 1899, pp. 45 to 65. 1900.

434 Rotatoria of the United States, with especial reference to those of the Great Lakes, by H. S. Jennings. Bulletin for 1899, pp. 67 to 104, plates 14 to 22. 1900.

435. A report of work on the protozoa of Lake Erie, with especial reference to the laws of their movements, by H. S. Jennings. Bulletin for 1899, pp. 105 to 114. 1900.

436. Notes on a collection of fishes from the rivers of Mexico, with description of 20 new species, by David Starr Jordan and John O. Snyder. Bulletin for 1899, pp. 115 to 147. 1900.

437. Notes on the Florida sponge fishery in 1899, by Hugh M. Smith. Bulletin for 1899, pp. 149 to 151. 1900.

438. Some chemical changes in the developing fish egg, by P. A. Levene. Bulletin for 1899, pp. 153 to 155. 1900.

439. The free-swimming copepods of the Woods Hole region, by William Morton Wheeler. Bulletin for 1899, pp. 157 to 192. 1900.

440. Observations on the life-history of the common clam, *Mya arenaria*, by James L. Kellogg. Bulletin for 1899, pp. 193 to 202. 1900.

441. The natural history of the starfish, by A. D. Mead. Bulletin for 1899, pp. 203 to 224, plates 23 to 26. 1900.

442. On the movements of certain lobsters liberated at Woods Hole, by Hermon C. Bumpus. Bulletin for 1899, pp. 225 to 230, plate 27. 1900.

443. Improvements in preparing fish for shipment, by Ralph W. Tower. Bulletin for 1899, pp. 231 to 235. 1900.

444. Report of a dredging expedition off the southern coast of New England, September, 1899, by Freeland Howe, jr. Bulletin for 1899, pp. 237 to 240. 1900.

445. The lobster fishery of Maine, by John N. Cobb. Bulletin for 1899, pp. 241 to 265, plates 28 to 32. 1900.

446. Fish parasites collected at Woods Hole in 1898, by Edwin Linton. Bulletin for 1899, pp. 267 to 304, plates 33 to 43. 1900.

447. Biological notes, No. 1. Bulletin for 1899, pp. 305 to 310. 1900.

448. The skeleton of the black bass, by R. W. Shufeldt. Bulletin for 1899, pp. 311 to 320, plate 44. 1900.

449. The chemical composition of the subdermal connective tissue of ocean sunfish, by Erik H. Green. Bulletin for 1899, pp. 321 to 324. 1900.

450. Report of the Commissioner for the fiscal year ending June 30, 1900, including the reports of divisions of fish culture, scientific inquiry, and fisheries, by George M. Bowers. Report for 1900, xxvi, pp. 1 to 191. 1900.

451. Investigations of the aquatic resources and fisheries of Porto Rico, by the U. S. Fish Commission steamer *Fish Hawk* in 1899. General report, by B. W. Evermann; the fisheries and fish trade, by W. A. Wilcox; the fishes, by B. W. Evermann and M. C. Marsh. Bulletin for 1900, vol. 1, pp. 1 to 350, plates 1 to 52. 1900.

452. A method of recording egg development for use of fish-culturists, by Claudius Wallich. Report for 1900, pp. 185 to 194, plate 1. 1900.

453. Statistics of fisheries of Middle Atlantic States by division of statistics, C. H. Townsend, assistant in charge. Report for 1900, pp. 195 to 310. 1900.

454. Statistics of the fisheries of the New England States, by division of statistics, C. H. Townsend, assistant in charge. Report for 1900, pp. 311 to 386. 1900.

455. The hydroids of the Woods Hole region, by C. C. Nutting. Bulletin for 1899, pp. 325 to 386. 1901.

456. Description of 15 new species of fishes from the Hawaiian Islands, by Oliver P. Jenkins. Bulletin for 1899, pp. 387 to 404. 1901.

457. Parasites of fishes of the Woods Hole region, by Edwin Linton. Bulletin for 1899, pp. 405 to 492, plates i to xxxiv. 1901.

458. The Mollusca of Porto Rico, by W. H. Dall and C. T. Simpson. Bulletin for 1900, vol 1, pp. 351–524, plates 53 to 58. 1901.

459. The Brachyura and Macrura of Porto Rico, by Mary J. Rathbun. Bulletin for 1900, vol 2, pp. 1 to 127, +*129 to *137, plates 1 and 2. 1901.

460. The Anomuran collections made by the *Fish Hawk* expedition to Porto Rico, by J. E. Benedict. Bulletin for 1900, vol 2, pp. 129–148, plates 3–6. 1901.

461. The Stomatopoda of Porto Rico, by R. P. Bigelow. Bulletin for 1900, vol. 2, pp. 149–160. 1901.

Serial No.

462. Report on Porto Rican Isopoda, by H. F. Moore. Bulletin for 1900, vol. 2, pp. 161–176, plates 7–11. 1901.
463. The Cirripedia collected near Porto Rico by the *Fish Hawk* expedition in 1898–99, by M. A. Bigelow. Bulletin for 1900, vol. 2, pp. 177–180. 1901.
464. The Polychætous Annelids of Porto Rico, by A. L. Treadwell. Bulletin for 1900, vol. 2, pp. 181–210. 1901.
465. Descriptions of two new leeches from Porto Rico, by J. Percy Moore. Bulletin for 1900, vol. 2, pp. 211–222, plates 12–13. 1901.
466. The Nemerteans of Porto Rico, by Wesley R. Coe. Bulletin for 1900, vol. 2, pp. 223–229. 1901.
467. The Echinoderms of Porto Rico, by H. L. Clark. Bulletin for 1900, vol. 2, pp. 231–263, plates 14–17. 1901.
468. The Alcyonaria of Porto Rico, by C. W. Hargitt and C. G. Rogers. Bulletin for 1900, vol. 2, pp. 265–287, plates I–IV. 1901.
469. The stony corals of Porto Rican waters, by T. Wayland Vaughan. Bulletin for 1900, vol. 2, pp. 289–320, plates I–XXXVIII. 1901.
470. Actinaria from the vicinity of Porto Rico, by J. E. Duerden. Bulletin for 1900, vol. 2, pp. 321– . 1901.
471. The sponges collected in Porto Rico in 1899 by the U. S. Fish Commission steamer *Fish Hawk*, by H. V. Wilson. Bulletin for 1900, vol. 2, pp. 1901.
472. Dredging and other records of the U. S. Fish Commission steamer *Albatross*, with bibliography relative to the work of the vessel, compiled by C. H. Townsend. Report for 1900, pp. 387–562, plates I–VII. 1901.
473. The French sardine industry, by Hugh M. Smith. Bulletin for 1901, pp. 1–26, plates 1–8. 1901.
474. Biological notes, No. 2, from biological laboratory at Woods Hole. Bulletin for 1901, pp. 27–33. 1901.
475. Description of a new oceanic fish found off southern New England, by Carl H. Eigenmann. Bulletin for 1901, pp. 35–36. 1901.
476. The egg and development of the conger eel, by Carl H. Eigenmann. Bulletin for 1901, pp. 37–44. 1901.
477. Investigations into the history of the young squeteague, by Carl H. Eigenmann. Bulletin for 1901, pp. 45–51. 1901.
478. A new isopod parasitic on the hermit crab, by Millet T. Thompson. Bulletin for 1901, pp. 53–56, plates 9–10. 1901.
479. The plants of western Lake Erie, with observations on their distribution, by A. J. Pieters. Bulletin for 1901, pp. 57–79, plates 11–20. 1901.
480. The Leptocephalus of the American eel and other American Leptocephali, by C. H. Eigenmann and C. H. Kennedy. Bulletin for 1901, pp. 81–92. 1901.

INDEX TO LIST OF PUBLICATIONS.

Serial No.

Acclimatization of fish in Pacific States 309
Actinaria of Porto Rico 470
Albatross dredging records 472
electric lighting of 73
explorations in Pacific Ocean 130, 284, 355
fishes collected by 326, 400
work of 130, 284, 310, 321, 332, 355, 472
Alcyonaria of Porto Rico 468
Alewife fishery of United States 401
Alexander, A. B 359
America, fishes of 336
American eel, Leptocephalus of 480
American shipworm, notes on 369
Anomurans of Porto Rico 460
Antrim County, Mich., fishes of 141
Apalachicola Bay, survey of 343
Aquaria at Central Station 186
World's Columbian Exposition 253
Aquarium, supply and pumping plants used for 253
Arkansas, fishes of 306
mollusks of 306
Artificial food for young fish 264
Atkins, Charles G 21
Atlanta Exposition, report on 338
Atlantic coast fishes, range of 233
salmon, propagation of 346
shad fisheries 403
Augur, C. H 275
Baird, Spencer F 3, 15, 46, 62, 65, 73
Bass, black, propagation of 347
rock, propagation of 347
Batrachians, natural history of 222
Bavarian Fishery Association 304
Bean, Barton A 409
Bean, Tarleton H 138, 145, 188, 237, 311
Benedict, J. E 460
Bibliography of Albatross work 472
Bibliography of U. S. F. C. publications 329
Bigelow, Maurice A 463
Bigelow, R. P 461
Biological notes 447, 475
Biological station for Florida coast 367
Gulf of Mexico 368
Biscayne Bay, notes on 333
Black bass in Utah 395
propagation of 347
skeleton of 448
Bollman, Charles H 141
Bony fishes, peripheral nervous system of 415
Bowers, George M 430, 450
Brachyura of Porto Rico 459
Brice, J. J 314, 317, 341, 342, 344
British Columbia, fisheries of 423
British Guiana, fishes of 260
Brook trout, propagation of 346
Bumpus, H. C 366, 416, 442
Bush, Katharine J 100
Calhoun County, Mich., fishes of 141
California, fishes of 288, 425
Canada, fisheries of 270
Central Station aquaria, observations on 186
Chamberlain, F. M 348
Check list of fishes of North and Middle America 336
Chemical changes in the developing fish egg 438
Cheney, A. Nelson 264, 376
Church, Daniel T 240
Cincinnati exposition 191
Cirripedia of Porto Rico 463

Serial No.

Clam culture 349, 432
Clam, food of 313
Clam, life history of 440
Clark, Frank N 257
Clark, Hubert Lyman 426, 467
Clear Lake, California, fishes of 288
Clinton County, Ky., fishes of 197
Clinton, G. P 253
Cobb, John N 393, 429, 445
Cod, food of 340
Coe, Wesley R 466
Collins, D. E 172
Collins, J. W 31, 137, 171, 172, 191, 192
Colorado River, fishes of 297
Columbia River, fishes of 290
salmon fisheries 290, 301, 318, 352
Commissioner, Report of 3, 62, 65, 192, 283, 298, 331, 344, 430, 450
Conger eel, development of 476
Copepods of the Woods Hole region 439
Corals of Porto Rico 469
Cotton States and International Exposition at Atlanta, report on 338
Cox, Ulysses O 303, 324, 328
Cozumel, Yucatan, fishes of 138
Crab fishery of Delaware Bay 166
Crab, hermit, parasites on 478
Crappie, propagation of 347
Crayfish, culture of 308
Crustaceans, natural history of 224
Cumberland River, fishes of 211
Dall, W. H 458
Darter, description of 197
Darters from Lake Maxinkuckee, two new species of 428
Dean, Bashford 202, 203, 214, 269
Decrease of food-fishes 62
Deep-water mollusca 100
Delaware Bay, king-crab fishery of 166
Delaware River and Bay, sturgeon fishery of 429
Disease of fish, gas bubble 431
District of Columbia, fishes of 409
Distribution of fish and fish eggs by U. S. Fish Commission 179
Drake, F. J 321, 332
Dredging and other records of the Albatross 472
Dredging expedition off coast of New England 444
Duerden, J. E 470
Dunbar, Scotland, marine hatchery at 261
Echinoderms of Porto Rico 467
Economic problems, relations of 243
Edwards, Vinal N 474
Eel, Leptocephalus of American 480
Eel River, explorations in 235
Egg and development of the conger eel 476
Eigenmann, Carl H 282, 475, 476, 477, 480
Electric lighting of Albatross 73
Entomostraca of Lake Superior 174
Entozoa of marine fishes 182
Erie, Lake, fishery industry of 271
European method of oyster culture 214
Evermann, Barton W 207, 246, 290, 297, 301, 303, 318, 323, 324, 327, 335, 336, 352, 358, 371, 405, 427, 428, 451
Exhibit of Fish Commission at Atlanta 338
at Chicago 311
at Cincinnati 191
at Nashville 407

Serial No.

Experiments in photography of live fishes 424
File-fish new to fauna of United States 412
Fish, acclimatization in Pacific States 309
Fish and fishing in British Guiana 260
Fish Commission publications, list of 329
relations to fishermen 392
Fish-culture at St. Andrew's Laboratory, Scotland 261
Fish-culture in America 391
Germany 304
ponds 294, 319, 346, 347
manual of 345
observations on 188
report on 192, 283, 298, 331, 344, 398
review of 75
Fish-cultural methods at the agricultural school at Freising 304
Fish-cultural stations for Pacific coast 314
Fish, distribution by U. S. F. C. in 1888–89 179
Fish egg, chemical changes in the developing 438
Fish-egg development, method of recording 452
Fish, food of 264
Fish, gas bubble disease of 431
Fish hatchery at Dunbar, Scotland 262
location of 333
Fish Hawk, construction of 70
work of 70
Fish nets, construction of 275
Fish parasites collected at Woods Hole 446, 457
occurrence of 165, 183, 250, 253, 370
Fish, propagation of 345
report on 15, 62, 65, 192, 283, 331, 344
rearing of 294, 319, 345, 346, 347
Fisheries Congress 237, 363, 364
for alewife 401
haddock 31
halibut 359
herring 356, 360
Irish mackerel 272
lobsters 373
menhaden 306
red snapper 390
salmon 290, 357
shad 403
maintenance of 226
of Canada 270
Florida 341, 342, 377, 386, 393
Gulf States 420
Indian River, Florida 341
interior waters 361
Lake Erie 271
Ontario 194
Middle Atlantic States 296, 453
New England coast 454
Pacific coast 293
Porto Rico 362, 451
sea and coast 240
South Atlantic States 212, 421
Texas 218
Fishermen, relations to Fish Commission 392
Fishery legislation 241
products, preservation of 417
trade, foreign, of United States 325
Fishes and fishlike vertebrates of North and Middle America 336
Fishes, artificial feeding of 294
collected by Albatross 326, 400
entozoa of 182
feeding of 294, 345
food for 264
in vicinity of Neosho, Mo 297
observations on 188
protection of 378
rearing of 294, 345
Fishes of America 336
Arkansas 306
Atlantic coast, range of 233
British Guiana 260
California 288
Canada 282
Colorado River 297
Columbia River 290
Cozumel, Yucatan 138
Cumberland River 211

Serial No.

Fishes of District of Columbia 409
Eel River 235
Florida 167, 198, 292, 342, 371, 377, 419
Georgia 142
Hawaiian Islands, new species of 433, 456
Indiana 235, 295
Indian Territory 306
Iowa 195, 288
Kadiak Island 410
Kentucky 196, 197, 211
Klamath River 351
Maine 236
Mexico 279, 436
Michigan 141
Minnesota 312, 328
Missouri 297
Missouri River 324
Monterey Bay 400
Nebraska 288
Neuse River 303
New Jersey 229, 230
North America 336
North Carolina 303
North Dakota 312
Porto Rico 427, 451
Potomac River 189
Revillagigedo 404
Santa Catalina 400
Sea Isle City, N. J 229
Southern New England 475
Tennessee 211
United States 339, 358
Vermont 327
Woods Hole, Mass 353
Fishing-vessels, improved types of 137
Florida, biological station for 333, 367
commercial sponges 374
fisheries 341, 342, 377, 386, 393
fishes of 167, 198, 292, 341, 342, 371, 377
fur-farming in 396
green turtle in 380
oyster-grounds of 382, 383, 385
Florida sponge fishery 437
Food for young fish 264, 294
of cod 340
menhaden 251
oyster, clam, and mussel 313
sources of marine 307
Forbes, S. A 147, 174, 253
Foreign-fishery trade 325
France, oyster-culture in 203
sardine, industry of 473
Fresh-water pearls of United States 278, 389, 397
Frog-culture 348
Fulton, T. Wemyss 261
Fur farming in Florida 396
Fur-seal, breeding-grounds of 317
islands, Russian 316
movements of 317
Fyke-net fisheries 226
nets, description of 226
Gas-bubble disease of fish 431
Geneva Lake, invertebrate animals of 147
Georgia, fishes of 142
oyster industry of 262
German Sea, scientific examination of 40
Germany, artificial propagation of sturgeon in 151
fish-culture in 304
Gilbert, Charles H 142, 288, 290, 326, 351, 400
Goode, G. Brown 31, 75, 243
Gorham, F. P 431
Grampus, construction and equipment of 171
investigation off New England, work of 172
Great Lakes, plankton studies in 252
Great Salt Lake, introduction of marine animals into 422
Greely, Arthur White 425
Green, Erik H 449
Green turtle on Florida coast 380
Green, William Spotswood 272
Gulf of Mexico, biological station for 368
Gulf States, fisheries of 420
Gurley, R. R 215
Haddock fishery of New England 31
Halibut fishery of northwest coast 359

Serial No.

Hall, Ansley ... 360
Hawaiian Islands, fishes of ... 433, 456
Hargitt, C. W ... 468
Henshall, James A ... 167, 292, 377
Hermit crab, new isopod parasitic on the ... 478
Herrick, C. Judson ... 415
Herrick, Francis H ... 247, 373
Herring fisheries ... 356
industry of Passamaquoddy Bay ... 360
History of the common clam ... 440
Howe, Freeland, jr ... 444
Hudson River, salmon in ... 376
Hydroids of Woods Hole ... 455
Ichthyological collections of the steamer Albatross ... 326
investigations in western Minnesota ... 312
Idaho, salmon investigations in ... 301, 318
Improvements in preparing fish for shipment ... 443
Ingersoll, Ernest ... 223
Indiana, fishes of ... 235, 295
Indian River, Florida, fisheries of ... 341
Territory, fishes of ... 306
mollusks of ... 306
Interior waters, fishery statistics of ... 361
International fishery congress ... 364
protection of fish ... 378
Invertebrate animals of Lake Geneva and Mendota ... 147
Investigation of commission for scientific examination of the German Seas ... 40
Iowa, fishes of ... 195, 288
Irish mackerel fisheries ... 272
Isopoda of Porto Rico ... 462
Isopod parasitic on the hermit crab, new ... 478
Jaffe, S ... 304
Jamaica mountain mullet, proposed introduction of ... 145
James, Bushrod W ... 378
Jenkins, Oliver P ... 433, 456
Jennings, H. S ... 434, 435
Joncas, L. Z ... 270
Jordan, David Starr ... 288, 336, 404, 436
Kadiak Island, tide-pool fishes from ... 410
Kalamazoo County, Mich., fishes of ... 141
Kellogg, James L ... 432, 440
Kendall, William C ... 233, 236, 297, 327, 339, 340, 358
Kentucky, fishes of ... 196, 197, 211
Keyes, C. M ... 271
Kibbe, I. P ... 387
King-crab fishery of Delaware Bay ... 166
Kirsch, Philip H ... 197, 211, 235, 295
Klamath River, fishes of ... 351
Kunz, George F ... 278, 389, 397
Lake Erie, fisheries of ... 271
plants of ... 479
protozoa of ... 435
white-fish culture in ... 388
Maxinkuckee, two new species of darters from ... 428
Ontario, fisheries of ... 194
Superior, entomostraca of ... 174
Lakes, investigation of ... 246
Lampreys of New York ... 372
Leeches of Porto Rico ... 465
Legislation, effect upon ocean fishes and fisheries ... 241
Leptocephalus of the American eel ... 480
Levene, P. A ... 438
Linton, Edwin ... 165, 182, 183, 250, 370, 446, 457
Lobster, development of ... 247
fishery, protection of ... 373
fishery of Maine ... 445
habits of ... 247
propagation of ... 247
Lobsters at Woods Hole, movements of ... 442
Lobsters transplanted to the Pacific coast ... 146
Lotsy, John P ... 313
Louisiana, investigations in ... 405
oyster-grounds ... 402
industry ... 384
McDonald, Marshall ... 131, 192, 283, 290, 298, 331
McGregor, R. C ... 404
McIntosh, W. C ... 261
Mackerel fisheries ... 272, 411
investigation ... 399
propagation ... 394
Macrura of Porto Rico ... 459
Maine, fishes of ... 236

Serial No.

Maine, giant-scallop fishery of ... 163
lobster fishery of ... 445
Marine animals for Great Salt Lake ... 422
fish hatchery ... 261, 333, 368
food, sources of ... 307
hatching and experiment station on Biscayne Bay, Fla ... 333
Marsh, Millard Caleb ... 427, 451
Maumee River, fishes of ... 295
Meehan, W. E ... 392
Meek, Seth Eugene ... 195, 288, 306, 352, 367
Mendota Lake, fish epidemic in ... 142
invertebrate animals of ... 147
Menhaden, fishery investigations of ... 307
food of ... 251
Mexico, fishes of ... 279, 436
Meyer, H. A ... 40
Michigan, fishes of ... 141
Middle Atlantic States, fisheries of ... 296, 453
Minnesota, fishes of ... 312, 328
Mississippi, investigations in ... 405
Mississippi River, mussel fishery and pearl-button industry of ... 414
Mississippi Sound, oyster-beds of ... 305
Missouri, fishes of ... 297
Missouri River, fishes of ... 324
Mobile Bay, oyster beds of ... 305
Mollusks, natural history of ... 223
of Arkansas and Indian Territory ... 306
of Porto Rico ... 458
Monterey Bay, fishes of ... 400
Moore, H. F ... 229, 349, 381, 402, 422, 462
Moore, J. Percy ... 394, 399, 465
Monroe, Ralph M ... 380
Mullet, Jamaica mountain ... 145
Mussel fishery and pearl-button industry of Mississippi River ... 414
Mussels of the United States, pearly fresh-water ... 413
Mussel, ribbed, food of ... 313
Myxosporidia, classification of ... 215
Nashville Exposition ... 407
National fisheries congress ... 363, 364
Nebraska, fishes of ... 288
Nemerteans of Porto Rico ... 466
Neosho, Mo., fishes near ... 297
Nets for fish, construction of ... 275
Net, submarine, description of ... 322
Neuse River, fishes of ... 303
New England coast, dredging expedition off ... 444
fisheries of ... 454
synaptas of ... 426
winter haddock, fishery of ... 31
New Jersey, fishes of ... 229, 230
New York, lampreys of ... 372
North America, fishes of ... 336
white-fish of ... 323
North Carolina, fishes of ... 303
North Dakota, fishes of ... 312
Northwestern United States and western Canada, explorations in ... 282
Notes on fish-culture in Germany ... 304
Nutting, C. C ... 455
Observations upon fish, etc ... 188
Ocean fishes and effect of legislation upon the fisheries ... 241
Ocean sun-fish, chemical composition of subdermal connective tissue of ... 449
Oemler, A ... 262
Oyster culture ... 263, 349
in Europe ... 214
France ... 203
Texas ... 387
food of ... 313
grounds of Florida ... 382, 383, 385
Louisiana ... 402
Mobile Bay and Mississippi Sound ... 305
South Carolina ... 202
industry of Georgia ... 262
Louisiana ... 384
Pacific coast ... 217
Willapa Bay ... 334
investigations in Apalachicola Bay, St. Vincent Sound, and St. George Sound ... 343
problems, factors in ... 381

Serial No.

Oysters transplanted to Willapa Bay 334
Pacific coast, establishment of fish-cultural stations on 314
fisheries 293
lobsters for 146
oyster industry 217
salmon propagation on 320
Pacific Ocean, explored by Albatross 130, 284
Pacific States, acclimatization of fish in 309
Page, William F 294
Parasites of fish 165, 183, 250, 253, 370
tiger shark 183
Woods Hole fishes 457
Passamaquoddy Bay herring fisheries 356, 360
Pearl-button industry and mussel fishery of Mississippi River 414
Pearl fishery of United States 389, 397
Pearls at Columbian Exposition 278
fresh-water, of United States 389, 397
Pearly fresh-water mussels of the United States 413
Peck, James I 251, 307
Penobscot Bay salmon fisheries 357
Peripheral nervous system of the bony fishes 415
Photography of live fishes, experiments in 424
Pieters, A. J 479
Plankton studies 365
in Great Lakes 252
Plants of western Lake Erie 479
Polychætous annelids of Porto Rico 464
Pond culture, notes on 30
Porto Rico, actinaria of 470
alcyonaria of 468
anomura of 460
brachyura and macrura of 459
cirripedia of 463
corals of 469
echinoderms of 467
fisheries of 45
fishes of 427, 451
investigations of the aquatic resources and fisheries of 451
isopoda of 462
leeches of 465
mollusca of 458
nemerteans of 466
polychætous annelids of 464
sponges of 471
stomatopoda of 461
Potomac River, fishes of 189
Preservation of fishery products for food 417
Propagation of bass 347
clams 349
fish 345
food-fishes, report on 15, 62, 65, 192, 283, 298, 331, 344, 430, 450
frogs 348
oysters 349
salmon 346
trout 346
Protection of fishes 378
Protozoa of Lake Erie 435
Publications of U. S. Fish Commission, list of 329, 406
Quelch, J. J 260
Quinnat salmon, natural history of 320
Rainbow trout, propagation of 319, 346
Rathburn, Mary J 459
Rathbun, Richard 41, 146, 192, 224, 283, 298, 331-423
Ravenel, W. de C 338, 407, 430, 450
Recording fish-egg development 452
Red-snapper fisheries 390
Reeves, I. S. K 253
Reighard, Jacob E 252, 365
Report of Commissioner 3, 62, 65, 192, 283, 298, 331, 344, 430, 450
Reptiles, natural history of 222
Revillagigedo, fishes of 404
Ritter, H. P 305
Rock bass, propagation of 347
Rogers, C. G 468
Rotatoria of the United States 434
Rowe, H. C 263
Ruge, John G 383
Rutter, Cloud 297, 410

Serial No.

Ryder, John A 181
Russian fur-seal islands 316
St. Andrew's laboratory, Scotland, fish-culture at 261
St. George Sound, survey of 343
St. Vincent Sound, survey of 343
Salmon fisheries, Columbia River 290
Penobscot Bay 357
hatching apparatus 21
in Hudson River 376
investigations in Columbia River 290, 301, 318, 352
investigations in Idaho 301, 318
Salmonoids, culture of 308
Salmon, propagation of 320, 346
stations on Pacific coast 314
Sandfort, fish-culture at 304
Santa Catalina, fishes of 400
Saprolegnia infesting fish 253
Sardine industry of France 473
Scallop fishery of Maine 163
Scientific examination of the German seas 40
inquiry, report on 192, 283, 298, 331, 344, 430, 450
research 243, 366
Schleswig-Holstein, Germany 151
Scudder, Charles W 329
Sea and coast fisheries 240
fisheries of the coast of New England 3
Sea Isle City, fishes of 229
Seagle, George A 319
Seal, William P 186
Shad fisheries of Atlantic coast 403
new species of 335
range of 379
Sharp, John 395
Sherwood, George H 474
Shipment, improvements in preparing fish for 443
Shipworm, notes on 369
Shufeldt, R. W 424, 448
Sigerfoos, Charles P 369
Simpson, Charles T 413, 458
Skeleton of the black bass 448
Smeltz, H. A 385
Smith, Hugh M 163, 166, 189, 194, 212, 226, 230, 232, 233, 283, 293, 296, 298, 302, 309, 331, 333, 339, 353, 357, 361, 374, 401, 409, 411, 412, 414, 430, 437, 450, 473, 474
Smith, Sanderson 41
Snyder, John O 436
South Atlantic States, fisheries of 212, 431
South Carolina oyster grounds 202
Southern New England, fish of 475
Southwick, J. M. K 241
Sponge culture 375
Sponge fishery of Florida 437
natural history of 224
Sponges, commercial, of Florida 374
Sponges of Porto Rico 471
Spring mackerel fishery of the United States 411
Squeteague, history of the young 477
Star-fish, natural history of 441
Statistical inquiry, report on 192, 283, 298, 331, 344, 430, 450
Status of U. S. Fish Commission 75
Stevenson, Charles H 218, 325, 379, 403
Stejneger, Leonard 316
Stiles, Charles Wardell 253
Stevenson, Charles H 417
Stomatopoda of Porto Rico 461
Stone, Livingston 320, 391
Stranahan, J. J 388
Sturgeon fishery of Delaware River and Bay 429
Sturgeon propagation 151, 269
Sucker, description of a new 207
Sun-fish, composition of subdermal connective tissue of 449
Surface, H. A 372
Swift, Franklin 343, 382
Synaptas of the New England coast 426
Tanner, Z. L 70, 130, 284, 310, 321
Taylor, W. Edgar 368
Temperature and other observations of the U. S. Fish Commission 41
Tennessee Centennial Exposition 407
Tennessee, fishes of 211

	Serial No.
Texas, fisheries of	218
investigations in	405
oysters of	387
Thompson, Millet T	478
Thysanocephalum crispum	183
Tide-pool fishes of California	425
Kadiak Island	410
Tiger shark, parasites of	183
Tile-fish, the reappearance of	416
Tower, Ralph W	443
Tow net, description of	322
Townsend, Charles H	217, 322, 334, 420, 421, 453, 454, 472
Treadwell, A. L	464
Trout culture	346
feeding of	294
rearing of	294, 304, 319, 346
True, Frederick W	222
Turtle, green, on Florida coast	380
United States, file-fish new to fauna of	412
U. S. Fish Commission dredging stations	41
publications	329
status of	75
United States, fish-culture in	391
fisheries of	401
fishes, description of new	358
range of	339
foreign fishery trade of	325
fresh-water pearls and pearl fishery of	278, 389, 397
list of fishes in	336
pearly fresh-water mussels of	413
Rotatoria of	434
southern spring mackerel fishery of	411
Utah, black bass in	395
Vaughan, T. Wayland	469
Vermont, fishes of	327
Vertebrates of North and Middle America	336
Vessels, improved types of	137
Wallich, Claudius	452
Warren, Andrew F	390
Washington County, Me., fishes of	236
Washington, fisheries of	423
Water investigations with reference to fish environment	246
Water supply for aquarium	253
Western Canada and Northwestern United States, explorations in	282
Wheeler, William Morton	439
White-fish culture in Lake Erie	388
methods of	257
new species of	232
of North America	323
Wilcox, W. A.	362, 451
Willapa Bay, oyster industry	334
oysters transplanted to	334
Wilson, jr., J. M	396
Wilson, H. V	375, 471
Winter haddock fishery of New England	31
Woods Hole, fishes of	353
fish parasites collected at	446, 457
free-swimming copepods of	439
hydroids of	455
laboratory operations	181, 474
Woolman, A. J	196, 198, 279, 312
World's Columbian Exposition, aquaria at	253
report on	311
Fisheries Congress, report of	237, 363
Worth, S. G	201
Wozelka-Iglau, Karl	308
Wytheville Station, operations of	131
Yellow perch, hatching of	201
Zacharie, F. C	384

NOTES ON THE TAGGING OF FOUR THOUSAND ADULT COD AT WOODS HOLE, MASSACHUSETTS.

By Hugh M. Smith,

Chief of Inquiry respecting Food-fishes, U. S. Commission of Fish and Fisheries.

HISTORY AND OBJECTS OF THE EXPERIMENT.

Taking advantage of the annual release of a large number of adult cod at the fish-cultural station of the United States Fish Commission at Woods Hole, Massachusetts, the writer suggested that it might be possible to secure some useful information concerning the natural history of the cod by marking or tagging the fish just before their liberation. Accordingly, in the winter of 1897–98, and in the three succeeding years, the available fish were tagged so that they might be recognized if recaptured.

The cod which were thus treated had been caught in October and November of each year on Nantucket Shoals and brought to the Woods Hole station in the wells of fishing vessels. The fish weighed from 2⅔ to 20 pounds, and were what the fishermen call the "shore cod," as distinguished from the "bank cod." Few of them weighed less than 3 pounds or more than 10 pounds, and the average weight when caught was probably not far from 6 pounds, although when released after tagging the average weight was only 5 pounds. The larger part of the supply was obtained by the Fish Commission schooner *Grampus*, Capt. E. E. Hahn in command.

The fish were caught with hand lines, and only those in which the hook wounds were trivial were retained. On arriving at the station they were transferred to large floating cars, in which they were held pending the ripening of their eggs. The egg-taking season is from the middle of November to the last of January or first of February, and the maturation of the eggs of individual fish often extends over a period of several weeks, during which time the fish are handled two or three times a week. As soon as a fish has been finally stripped it is set at liberty, either in Vineyard Sound or Buzzards Bay.

Owing to the captivity and to the rather rough handling to which the brood cod are necessarily subjected in taking their spawn and milt, in addition to the loss of vitality incident to the spawning process, they

become much emaciated and some of them succumb, notwithstanding clams and fish are fed to them.

The tags were cut from sheet copper, as this metal is cheap and withstands the action of salt water for a long time. A few tags made of pure sheet tin were used, but they proved to be unsatisfactory. The copper tags were from five-sixteenths to three-fourths of an inch long, and one-fourth of an inch wide. A small hole was punched in one end, through which a fine copper wire was passed, attaching the tag to the fish. The average weight of the tags, with wire, was 0.65 gram, or about one-fourth that of a 10-cent silver piece.

The places of attachment were the bases of the three dorsal fins, the bases of the anal fins, and the upper and lower caudal lobes. Most of the tags were fastened to the upper part of the caudal fin, near its junction with the peduncle, where the rays are toughest and the tags are least liable to be torn out. To facilitate the passage of the wire through the fin an aneurism needle was used. After the weight, length, and sex of the fish were determined and recorded, and the tag was attached, they were towed into the sound or bay in live-cars and turned loose.

The record kept for each tagged fish comprised the following items: Tag number, position of the tag, date when released, where released, the weight, length, sex, and spawning condition (whether spent or immature).

In order to acquaint fishermen and fish-dealers with the purposes of the tagging, and to encourage the preservation and return of the tags, a circular was printed and distributed in the fishing towns in November, 1897. The circular contained a cut of a cod showing the position of the tags, and asked that any person coming into possession of a cod having such a tag forward the latter by mail to the U. S. Fish Commission, Washington, D. C., or to the U. S. Fish Commission station, Woods Hole, Massachusetts, together with the following information concerning the fish: The date when caught; on what grounds taken; weight before being dressed; total length measured from end of nose to end of tail; sex; and whether milt or eggs were ripe, large but not ripe, or immature.

Additional publicity was given to the experiment by a number of timely articles in the newspapers of New York, Boston, and other large cities, as well as in the press of the fishing towns. The novelty of the scheme excited unusual interest and the hearty cooperation of the fishermen was secured, as shown by the large number of tags recovered and the filing of full data regarding the captured fish.

The tagging began each winter about the 1st of December and continued for 2 or 2½ months. The work was usually brought to a close by the formation of anchor ice and the consequent killing of all the fish that remained in the cars.

The number of fish tagged during the four winters covered by the experiment was 4,019, divided as follows among the different years:

1897–1898	562
1898–1899	593
1899–1900	1,421
1900–1901	1,443

Among the subjects on which it was expected the tagging might throw light and thus prove of practical interest, were the rate of growth of the cod, the frequency of its spawning, the extent to which the individual fish migrate, the rate of movement, etc.

Although it is probable that other tagged fish may hereafter be captured, it is thought that sufficient time has elapsed and enough tags have been recovered to warrant the present summary of the outcome of the experiment.

NUMBER OF TAGGED FISH CAPTURED.

From the accompanying table it will be seen that of the 4,019 fish tagged and released 140 were subsequently captured by commercial fishermen up to December 31, 1901. The number taken during each of the four seasons covered by the experiment was as follows:

1897–1898	35
1898–1899	30
1899–1900	22
1900–1901	53

In addition to the foregoing there were quite a number of tagged fish taken for which records are unobtainable, the fishermen having lost or mislaid the tags or failed to report the captures. In New Jersey, New York, and Rhode Island fully 20 tagged fish are known to have been caught, but the tag numbers are unknown and hence the captures can not be taken into consideration. Some of the fishermen in Narragansett Bay, Rhode Island, took a number of cod which they liberated alive on discovering the tags without noting the tag numbers. In some cases fishermen are known to have unreported tags in their possession which they are keeping as curiosities. In a few instances fishermen have failed to report the catching of tagged cod through fear that there was some penalty attached to the killing of such fish.

Several reports of the capture of tagged cod on the coasts of Maine and Nova Scotia could not be verified.

In a number of instances the tags have not been observed at the time the fish were caught, but have been discovered by the wholesale dealers to whom the fish were sold. Occasionally tags have been forwarded by consumers. When fish were salted on the grounds, tags have sometimes been recovered months afterwards in the houses of salt-fish dealers or the skinning lofts of preparers of boneless cod. In at least one case a tag was overlooked by the man who caught the fish, by the men who cleaned, split, and salted it, by the man who unloaded it from the vessel, by those who handled it on shore, by the wholesale dealer, and by the retail dealer; it was eventually found by a consumer remote from the shore and forwarded to the Commission.

Record of the tagged cod released at Woods Hole and subsequently captured by commercial fishermen, 1897–1901.

Tag No.	When released.	Where released.	When caught.	Where caught.
135	Feb. 14, 1898	Mouth of Woods Hole Harbor.	Mar. 22, 1898	Off Block Id., R. I.
210	Dec. 27, 1897	2 miles SW. bell buoy, Quicks Hole.	May 3, 1898	3½ miles SSW. Chatham, Mass.
261	Jan. 8, 1898	Buzzards Bay, 1 m. NE. Robinsons Hole.	Apr. 9, 1898	1½ miles E. Sankaty Head L. H., Mass.
265	.....do.....	.....do.....	May —, 1898	Off Brenton Reef, R. I.
315	Jan. 15, 1898	3 miles N. Gay Head light-house.	May 20, 1898	Off Chatham, Mass.
317	.....do.....	.....do.....	May 28, 1898	In trap at Monomoy, Mass.
320	.....do.....	.....do.....	Sept. 5, 1898	Nantucket Shoals.
324	.....do.....	.....do.....	May 18, 1898	SE. Brenton Reef L. S., R. I.
332	Jan. 18, 1898	3 miles W. Gay Head light-house.	July 7, 1898	South Channel.
337	.....do.....	.....do.....	Feb. 19, 1898	SW. of Block, Id., R. I.
339	.....do.....	.....do.....	May 8, 1898	½ mile off Sankaty Head L. H., Mass.
360	Jan. 22, 1898	2 miles NW. Gay Head light-house.	Feb. 4, 1898	Off West Hampton Beach, N. Y.
361	.....do.....	.....do.....	Mar. 14, 1898	Off Pt. Pleasant, N. J.
371	.....do.....	.....do.....	Apr. 18, 1898	2 miles from Brenton Reef L. S., R. I.
375	.....do.....	.....do.....	Mar. 22, 1898	2 miles ESE. Green Hill, R. I.
376	.....do.....	.....do.....	July 23, 1898	Off Chatham, Mass.
400	Jan. 25, 1898	4 miles SW. Tarpaulin Cove light-house.	Apr. 12, 1898	Off Block Id., R. I.
418	.....do.....	.....do.....	May 2, 1898	Nantucket Shoals, off Sankaty Head L. H.
438	Jan. 31, 1898	2½ miles NE. Robinsons Hole.	Apr. 26, 1898	In pound net 10 miles E. Westerly, R. I.
448	.....do.....	.....do.....	Feb. 18, 1898	Off Napeague Beach, N. Y.
453	.....do.....	.....do.....	Apr. 5, 1898	Off NE. shore Gardiner Id., N. Y.
458	.....do.....	.....do.....	Nov. 15, 1898	Off Newport, R. I.
469	.....do.....	.....do.....	May 20, 1898	1 mile SE. Coggeshall Ledge, off Newport, R. I.
483	.....do.....	.....do.....	Mar. —, 1898	Near Green Hill, R. I.
488	.....do.....	.....do.....	Feb. 18, 1898	Off West Hampton Beach, N. Y.
489	.....do.....	.....do.....	May —, 1898	Off Newport, R. I.
495	Feb. 10, 1898	Mouth of Woods Hole Harbor.	May 11, 1898	In trap at Watch Hill, R. I.
511	.....do.....	.....do.....	Mar. 27, 1898	Nantucket Shoals, off Siasconset.
512	.....do.....	.....do.....	May 24, 1898	Nantucket Shoals, near Stone Horse Rip.
517	.....do.....	.....do.....	May 1, 1898	In trap near Wickford L. H., R. I.
533	.....do.....	.....do.....	Mar. 23, 1898	S. by E. Fisher Id., N. Y.
548	.....do.....	.....do.....	May 21, 1898	Off Rogers shoal, near Monomoy Pt., Mass.
550	.....do.....	.....do.....	Apr. 4, 1898	Off Block Id., R. I.
555	.....do.....	.....do.....	Aug. 1, 1898	Nantucket Shoals, 18 miles E. Sankaty Head.
561	.....do.....	.....do.....	Mar. —, 1898	Nantucket Shoals.
820	Dec. 24, 1898	3 m SSE. Tarpaulin Cove light-house.	Dec. 26, 1898	4 miles S. Newport, R. I.
826	.....do.....	.....do.....	Mar. 3, 1899	5 miles off Wainscott, N. Y.
851	Dec. 30, 1898	Buzzards Bay, 1½ miles NE. Robinsons Hole.	May 20, 1899	6 miles S. Block Id., R. I.
863	.....do.....	.....do.....	Apr. 17, 1899	2 miles SW. Pt. Judith, R. I.
868	.....do.....	.....do.....	Jan. 24, 1899	6 miles off Amagansett, N. Y.
880	.....do.....	.....do.....	Nov. 1, 1899	Nantucket Shoals, 2 miles SE. Sankaty Head L. H
888	.....do.....	.....do.....	Jan. 19, 1899	3 miles off Amagansett, N. Y.
889	.....do.....	.....do.....	Mar. 20, 1899	Georges Bank in 33 fathoms.
921	Dec. 31, 1898	Off Jobs Neck	July 23, 1899	Nantucket Shoals, 12 miles E. Round Shoal L. S.
922	.....do.....	.....do.....	Feb. 6, 1899	17 miles W. Montauk Pt., off Amagansett, N. Y.
927	.....do.....	.....do.....	Aug. 10, 1899	7 miles SE. Chatham Lights, Mass.
980	Jan. 17, 1899	2 miles S. Quicks Hole.	Jan. 27, 1899	Mecox Inlet, N. Y.
987	.....do.....	.....do.....	Jan. 28, 1899	5 miles off Amagansett, N. Y.
A 25	Jan. 18, 1899	1½ miles S Cuttyhunk.	Apr. 24, 1899	Nantucket Shoals, off Sankaty Head.
A 87	.....do.....	.....do.....	Jan. 24, 1899	Mussel Bed, off Pt. Judith, R. I.
A 139	Jan. 1, 1901	Mouth of Lackeys Bay	Mar. 29, 1901	3 miles SE. Fisher Id., N. Y.
A 141	.....do.....	.....do.....	Jan. 9, 1901	SE. Squibnocket Head, Marthas Vineyard.
A 165	.....do.....	.....do.....	June 14, 1901	Nantucket Shoals, 5 miles off Siasconset.
A 235	Jan. 7, 1901	Mouth of Woods Hole Harbor.	May —, 1901	2 miles N. Block Id , R. I.
A 252	.....do.....	.....do.....	Apr 12, 1901	10 miles off Atlantic City, N. J.
A 296	.....do.....	.....do.....	May 24, 1901	1 mile SE. Chatham L. S. S., Mass.
A 298	.....do.....	.....do.....	May 4, 1901	Nantucket Shoals, 2 miles SE. Sankaty Head.
A 309	Jan. 8, 1901	2 miles SE. Nobska ...	May 2, 1901	Near S end Dutch Id., Narragansett Bay, R. I
A 389	.....do.....	.....do.....	Mar. 17, 1901	Off Narragansett Beach, R. I.
A 421	.....do.....	Mouth of Woods Hole Harbor.	June 14, 1901	Nantucket Shoals, 5 miles off Siasconset.

Record of the tagged cod released at Woods Hole and subsequently captured by commercial fishermen, 1897–1901—Continued.

Tag. No.	When released.	Where released.	When caught.	Where caught.
A 431	Jan. 8, 1901	Mouth of Woods Hole Harbor.	Jan. 30, 1901	2½ miles SE. Squibnocket Head, Marthas Vineyard.
A 472	.....do.....	.....do.....	Mar. 20, 1901	Between Beaver Tail and Whale Rock, Narragansett Bay, R. I.
A 522	Jan. 10, 1901	Off can buoy, mouth of Woods Hole Harbor.	May 3, 1901	Nantucket Shoals, 2 miles NNE. Sankaty Head.
A 523	.....do.....	.....do.....	June 14, 1901	Nantucket Shoals, 5 miles off Siasconset.
A 536	.....do.....	.....do.....	Apr. 28, 1901	Nantucket Shoals, 3 miles NNE. Sankaty Head.
A 573	.....do.....	.....do.....	Apr. 10, 1901	3 miles N. by E. Montauk Pt., N. Y.
A 606	Jan. 15, 1901	⅛ mile S. Tarpaulin Cove.	Jan. 30, 1901	3 miles off Amagansett, N. Y.
A 643	.....do.....	.....do.....	Feb. 12, 1901	Off Watch Hill, R. I.
A 663	.....do.....	.....do.....	July 15, 1901	Nantucket Shoals, 4 miles S. Gt. Rd. Sh. Whistling Buoy.
A 666	.....do.....	.....do.....	Apr. 9, 1901	Off N. end Rose Id., Narragansett Bay, R. I.
A 684	.....do.....	.....do.....	June 1, 1901	Off SW. Ledge, Block Id., R. I.
A 709	.....do.....	Off mouth of Woods Hole Harbor.	May 8, 1901	1 mile NE. Muskeget Id., Mass.
A 721	.....do.....	.....do.....	Jan. 28, 1901	2 miles off Southampton, N. Y., in 60 ft. of water.
A 722	.....do.....	.....do.....	May 8, 1901	1 mile NE. Muskeget Id., Mass.
A 723	Jan. 16, 1901	.....do.....	Sept. 1, 1901	Not known.
A 744	.....do.....	.....do.....	Apr. 6, 1901	Off Rose Id., Narragansett Bay, R. I.
A 747	.....do.....	.....do.....	Mar. 8, 1901	Narragansett Bay, near Rose Id., R. I.
A 758	.....do.....	.....do.....	May —, 1901	Nantucket Shoals, 2 miles SE. Sankaty Head.
A 818	Jan. 18, 1901	1½ miles SE. Jobs Neck.	May —, 1901	6 miles off Block Id., R. I.
A 819	.....do.....	.....do.....	July 12, 1901	Nantucket Shoals, off N. end Fishing Rip Shoal.
A 824	.....do.....	.....do.....	June 29, 1901	Nantucket Shoals, 15 miles E. by S. Sankaty Head L. H.
A 870	.....do.....	.....do.....	Dec. —, 1901	Off Nomans Land.
A 876	.....do.....	⅛ mile SE. Jobs Neck.	May 15, 1901	In trap on W. side Block Id., R. I.
A 896	.....do.....	.....do.....	May 10, 1901	1 mile NW. Muskeget L. S. S., Mass.
A 944	Jan. 28, 1901	¾ mile SE. can buoy off Woods Hole Harbor.	Apr. 9, 1901	3 miles N. by E. of Montauk Pt., N. Y.
B 8	Jan. 18, 1899	1½ miles S. Cuttyhunk.	June 19, 1899	12 miles SE. Chatham, Mass.
B 53	Jan. 24, 1899	3 miles NW. Cedar Tree Neck.	June 20, 1899	Nantucket Shoals, on Fishing Rip.
B 89	.....do.....	.....do.....	Mar. 27, 1899	Off Surfside, S. side Nantucket Id.
C 23	Jan. 23, 1899	Buzzards Bay, 2 miles N. Robinsons Hole.	June 10, 1899	3 miles SW. Block Id., R. I.
C 46	.....do.....	.....do.....	Aug. 1, 1899	10 miles ESE. Chatham, Mass.
C 51	.....do.....	.....do.....	May 2, 1899	In pound net off Narragansett Beach, R. I.
C 69	Jan. 26, 1899	.....do.....	May 17, 1899	Off Newport, R. I.
C 95	Feb. 3, 1899	3 miles NE. Gay Head.	May 9, 1900	On Round Hill Ledge, 5½ to 6 miles W. Pt. Judith, R. I.
C 98	.....do.....	.....do.....	June 26, 1899	Outer edge Cox's Ledge.
D 2	.....do.....	.....do.....	May 5, 1899	1½ miles S. Block Id., R. I.
D 3	.....do.....	.....do.....	May 23, 1899	Nantucket Shoals, 1 mile off Sankaty Head L. H.
D 41	.....do.....	.....do.....	Apr. 18, 1899	Nantucket Shoals, off Sankaty Head.
D 61	.....do.....	.....do.....	Aug. 25, 1899	Nantucket Shoals, 15 miles off Sankaty Head.
D 81	Feb. 4, 1899	2 miles S. Quicks Hole.	Mar. 10, 1899	Off Fire Id., N. Y.
D 82	.....do.....	.....do.....	Apr. 10, 1899	2 mi. SW. Pt. Judith, R. I.
E 46	Dec. 7, 1899	1 mile S. Tarpaulin Cove.	Apr. 16, 1900	Nantucket Shoals, 2 miles SE. Sankaty Head L. H.
G 35	Dec. 22, 1899	1 mile E. Quicks Hole bell buoy.	Apr. 9, 1900	⅛ mile off Seagirt, N. J.
H 64	Dec. 28, 1899	2 miles SE. Tarpaulin Cove.	June 8, 1900	10 miles SE. Chatham, Mass.
I 55	Jan. 6, 1900	2½ miles NE. Gay Head light-house.	Apr. 30, 1900	About 3 miles S. Brenton Reef L. S. S., R. I.
K 2	.....do.....	.....do.....	Apr. 17, 1900	Nantucket Shoals, 3 miles E. Sankaty Head.
K 55	.....do.....	2½ miles E. Job's Neck.	Apr. 19, 1900	Nantucket Shoals, 2 miles SE. Sankaty Head L. H.
L 70	Jan. 15, 1900	¾ mile SW. Nobska light-house.	Apr. 18, 1900	Do.
M 35	Jan. 16, 1900	1 mile SE. Job's Neck.	Apr. —, 1900	Nantucket Shoals, off Siasconset.
M 64	Jan. 17, 1900	1 mile S. Nobska light-house.	Apr 27, 1900	Nantucket Shoals, off E. end Nantucket.
M 81	.....do.....	.....do.....	Apr. 19, 1900	Nantucket Shoals, 2 miles SE. Sankaty Head L. H.
N 8	.....do.....	.....do.....	Apr 28, 1900	Do.
N 26	.....do.....	.....do.....	Apr. 29, 1900	Do.

Record of the tagged cod released at Woods Hole and subsequently captured by commercial fishermen, 1897–1901—Continued.

Tag No.	When released.	Where released.	When caught.	Where caught.
N 41	Jan. 19, 1900	1½ miles SSE. Tarpaulin Cove light-house.	May 25, 1900	Clinton, Conn., in lobster-pot.
N 91	do	do	Apr. 20, 1900	2 miles S. of E. end Fisher Id., N. Y.
O 36	do	Off can buoy, mouth of Woods Hole Harbor.	Feb. 7, 1900	5 miles E. Mantoloking, N. J.
P 76	Jan. 23, 1900	3 miles SE. Tarpaulin Cove light-house.	May 14, 1900	½ mile off Siasconset, Nantucket.
P 96	do	do	July 14, 1900	15 miles SE. Chatham Lights, Mass.
R 55	Jan. 24, 1900	1 mile S. Nobska light-house.	Apr. 14, 1900	Nantucket Shoals, 2 miles E. Sankaty Head.
S 10	Jan. 25, 1900	1 mile SW. can buoy, mouth of Woods Hole Harbor.	Feb. 12, 1900	3 miles off Amagansett, N. Y.
S 43	do	do	Feb. 7, 1900	2 miles off Amagansett, N. Y.
S 98	do	do	Apr. 24, 1900	Nantucket Shoals, off Siasconset, Nantucket.
T 32	Jan. 26, 1900	1 mile E. Job's Neck	Apr. 10, 1900	Nantucket Shoals, 1½ miles S. by E. Sankaty Head.
T 92	Dec. 19, 1900	1 mile S. Tarpaulin Cove.	Feb. 19, 1901	Off West Hampton Beach, N. Y.
U 23	Dec. 20, 1900	Off can buoy, mouth of Woods Hole Harbor.	Apr. 7, 1901	5½ miles off Block Id., R. I.
U 28	do	do	Apr. 20, 1901	Off Atlantic City, N. J.
U 36	do	do	Dec. 27, 1900	3 miles SW. Saconnet L. H., R. I.
U 76	do	do	May 15, 1901	Nantucket Shoals, 3 miles SE. Nantucket Id.
V 1	Dec. 21, 1900	Near bell buoy, off Nobska.	Jan. 12, 1901	¾ mile off Southampton, N. Y.
V 32	do	do	May 8, 1901	Nantucket Shoals, about 2 miles NNE. Sankaty Head.
V 40	do	do	July 4, 1901	Nantucket Shoals, off Great Round Shoal.
V 68	do	do	Jan. 14, 1901	Off northern coast of N. J.
V 75	do	do	Jan. 30, 1901	10 miles off Atlantic City, N. J.
W 6	Dec. 29, 1900	Off can buoy, mouth of Woods Hole Harbor.	Jan. 8, 1901	1½ miles off Southampton, N. Y.
W 48	do	do	Jan. 17, 1901	Off Squibnocket Head, Marthas Vineyard.
W 81	do	do	Feb. 23, 1901	Off Southampton, N. Y.
W 83	do	do	Jan. 2, 1901	Off Squibnocket Head, Marthas Vineyard.
W 89	do	do	Mar. 15, 1901	10 miles off Atlantic City, N. J.
X 37	Dec. 31, 1900	3 miles SE. Tarpaulin Cove light-house.	Apr. 18, 1901	Beaver Tail Ledge, ½ mile W. by S. Brenton Reef L. S., R. I.
X 40	do	do	Jan. 14, 1901	Off Squibnocket Head, Marthas Vineyard.
X 60	do	do	Apr. 30, 1901	1 mile E. West Chop L. H., Mass.

Unless otherwise stated, all localities where tagged fish were released are in Vineyard Sound.

DISPERSAL AND MOVEMENTS OF THE TAGGED FISH.

The appended classified table shows the localities in which the tagged cod were caught and the months in which they were taken in each locality. The following points relative to the movements of the tagged fish have been developed by the experiments:

(1) The tagged cod have been found in the coastal waters of the middle Atlantic region throughout the year, but in largest numbers in April and May, when nearly 50 per cent were taken. Comparatively few have been captured any year between July and December.

(2) The range of the tagged cod, as judged by those caught, is from Georges Bank to Atlantic City, New Jersey. The localities mostly frequented were the south shore of Long Island, Narragansett Bay and the adjacent shores, and Nantucket Shoals.

(3) Shortly or immediately after their release, there was a well-marked southerly and westerly movement to the shores of New York and New Jersey, where they remained during the first four months of the year.

A feature of the fishing season of 1900–1901 was the taking of tagged fish farther south than in any of the other years, in the vicinity of Atlantic City, which is about the southern limit of the cod fishery.

On January 31, 1901, Capt. D. C. Clark wrote:

> When fishing for cod about 12 miles south of Absecon Light, abreast of Atlantic City, yesterday, we discovered, while gutting fish, a cod with tag V 75. It weighed about 4 pounds and was in poor condition. It had no spawn in it, and looked as if it had been spawned out some time. We caught it in about 10½ fathoms of water, about 10 miles offshore, with 300 or 400 other fish. There have been thousands of cod caught here this fall and winter, but this is the first one with a tag that has been taken.

On March 15, April 12, and April 15 Captain Clark caught cod bearing tags, and two other tagged fish were taken in the same locality by other fishermen about March 1.

(4) During March, April, and May the fish sought Narragansett Bay and the shores of Rhode Island, where a few were also found in January, February, June, November, and December.

(5) The largest number of fish were caught off Nantucket, on Nantucket Shoals, in April and May; in this region a few were also taken in March and the summer months. In October and November, however—the months when the fish were first caught on these grounds—only one of the tagged fish has as yet been taken, notwithstanding active fishing at that season by the commercial fishermen. The Fish Commission schooner *Grampus*, which during the years in question has caught from 4,000 to 6,000 cod annually on the Nantucket Shoals in October and November, has never taken a tagged fish.

This circumstance suggests (1) that the fish which frequent the Nantucket Shoals in the spring and summer months represent a different body or run from those caught in the same locality in fall, and (2) that the tagged fish which have frequented the shoals leave on the approach of the time when they were first taken and go to grounds at present unknown—perhaps to New York and New Jersey.

(6) The fish showed but a slight tendency to go to the eastward of Cape Cod or of Nantucket Shoals. A few were taken between May and August, southeast of Chatham, but only one was reported from South Channel and one from Georges Bank. The latter (No. 889) was caught by a Gloucester fishing schooner on March 27, 1899, at a depth of 33 fathoms.

(7) None of the tagged fish has been taken north of Cape Cod. If the schools with which the tagged fish mingled on Nantucket Shoals and elsewhere behaved as did the tagged fish, it is evident that the cod inhabiting the grounds off southern New England, New York, and New Jersey belong to a distinct body, and are not simply a part of the vast shoals found in Massachusetts Bay and on the coast of Maine.

The very active shore cod fishing carried on with boats and vessels between Cape Cod and the Bay of Fundy would almost inevitably have disclosed the presence of tagged fish had any been in those waters. There is but one report of anything like a definite character regarding the taking of a tagged cod in this region. This was communicated by Mr. F. G. Conley, mate of the *Grampus*, and related to a fish said to have been caught off Jonesport, Me., in the winter of 1897–98, but repeated efforts failed to verify the capture.

(8) The conclusion seems legitimate that the cod which resort to the shores of New York and New Jersey in winter do not represent an independent body of fish which have come from some offshore grounds at this season, but are a part of the great schools of shore cod which also frequent the southern New England coast.

(9) The month when the fish were released (that is, whether in December, January, or February) seemed to have no relation to the direction in which they moved, although it may be noted that none of the fish released as late as February was taken as far west and south as New Jersey, and that of the captured fish released in December a large percentage were from the shores of New Jersey and New York.

(10) The particular place where the fish were released—whether at the northern end, southern end, or the intermediate part of Vineyard Sound, or in Buzzards Bay—had no determining influence on their movements as evidenced by the localities in which caught.

(11) Some fish released side by side became widely separated in a short time, while other lots appeared to keep together for several months. Some were moved by individual instincts, others seemed to act en masse. The following references will illustrate the different behavior of particular lots of cod:

Of 55 cod released in Vineyard Sound 2 miles northwest of Gay Head light on January 22, 1898, 5 were recaptured, as follows: February 4, off Westhampton Beach, Long Island; March 14, off Point Pleasant, N. J.; March 22, off Greenhill, R. I.; April 18, off Brenton Reef lightship, Rhode Island; July 23, off Chatham, Mass.

Of 79 fish liberated in Vineyard Sound 1 mile south of Nobska light on January 17, 1900, 4 were recaptured, as follows: April 16, 2 miles southeast Sankaty light, Nantucket; April 27, off east end of Nantucket; April 28, 2 miles southeast Sankaty Light, Nantucket; April 29, 2 miles southeast Sankaty light, Nantucket.

(12) Of some lots of released fish, a comparatively large percentage was recaptured, while of others none was taken. This is illustrated by the following references: (1) Of 54 fish released January 31, 1898, in Vineyard Sound 2½ miles northeast of Robinsons Hole, 9, or nearly 17 per cent, were recaptured; (2) of 71 fish released February 10, 1898, at the mouth of Woods Hole Harbor, 7, or nearly 10 per cent, were recaptured; (3) of 50 fish released December 30, 1898, in Buzzards Bay near Robinsons Hole, 6, or 12 per cent, were recaptured.

On the other hand, none of the following lots was recaptured: 53 fish released January 11, 1898, 3 miles west of Gay Head light; 96 fish released December 13, 1899, 4 miles southwest of Nobska light; 79 fish released December 23, 1899, in the latter place.

Summary, by months, of the regions in which tagged cod were caught, 1897-1901.

Regions.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Off New Jersey	2	1	2	3									8
Off New York	8	8	4	4									24
Off Connecticut					1								1
Rhode Island shores	1	1	5	8	10						1	2	28
Off Block Island		1	1	3	5	2							12
Off Marthas Vineyard	5			1								1	7
Nantucket Shoals			3	17	9	5	4	2	1		1		42
On Cox's Ledge						1							1
Off Muskeget Island					3								3
Monomoy Point					2								2
Off Chatham					3	2	2	2					9
South Channel							1						1
Georges Bank			1										1
Miscellaneous									1				1
Total	16	11	16	36	33	10	7	4	2		2	3	140

NOTES ON THE RATE OF TRAVEL.

Observations on this point are obviously unsatisfactory and unreliable. While the times and places of release and of capture of given fish may be accurately determined, it can not be stated in any case what route the fish has taken or how long it may have been in a locality before it was caught. Without laying undue stress on this subject, the records of a few cod which were caught a short time after their release may be examined. It is evident that the sooner a fish was captured and the less time it thus had to roam, the more accurate was the basis afforded for determining how fast it moved.

Some fish appear to have moved rapidly away as soon as released, while others remained in the vicinity and, when caught, had traveled only a few miles.

The tagged cod recaptured in the shortest time after liberation (No. 820) was released in Vineyard Sound, 3 miles SSE. of Tarpaulin Cove light, on December 24, 1898, and was caught 4 miles south of Newport, R. I., on December 26, 1898. The distance between these two points, by the most direct water route, is 33 miles.

Quite a number of fish each season were taken on the shores of Long Island within a comparatively short time after being liberated. Thus, No. 360, released January 22, 1898, 2 miles NW. of Gay Head light, was caught February 4, 1898, off Westhampton Beach, New York; time, 13 days; distance, 131 miles. No. S 10, released January 25, 1900, 1 mile SW. mouth of Woods Hole Harbor, caught February 12, 1900, 3 miles off Amagansett, New York; time, 18 days; distance, 88½ miles. No. S 43, released on the same day as the preceding, caught February 7, 1900, 2 miles off the same place; time, 13 days;

distance, 89 miles. No. W 6, released December 29, 1900, 2 miles SW. mouth Woods Hole Harbor, caught January 8, 1901, 1½ miles off Southampton, New York; time, 10 days; distance, 107 miles. No. A 606, released January 15, 1901, one-half mile south of Tarpaulin Cove, Vineyard Sound, caught January 30, 1901, 3 miles off Amagansett, New York; time, 15 days; distance, 81 miles. No. A 721, released January 15, 1901, off the mouth of Great Harbor, Woods Hole, caught January 28, 1901, 2 miles off Southampton, New York; time, 13 days; distance, 102 miles. No. 980, released January 17, 1899, 2 miles south of Quicks Hole, Vineyard Sound, caught January 27, at Mecox Inlet, New York; time, 10 days; distance, 86 miles. No. 987, released at the same time and place, caught January 28, 1899, 5 miles off Amagansett, New York; time, 11 days; distance, 76 miles.

No. A 87 was released January 18, 1899, 1½ miles south of Cuttyhunk, and caught January 24, 1899, off Point Judith, Rhode Island; time, 6 days; distance, 30 miles; and No. O 36 was released January 19, 1900, off mouth of Great Harbor, Woods Hole, and caught February 7, 1900, 5 miles east of Mantoloking, New Jersey; time, 19 days; distance, 150 miles.

In contrast with the foregoing are the following fish liberated near Woods Hole Harbor and captured off Squibnocket Head, on the outer side of Marthas Vineyard, the distance by the most direct route being about 24 miles: No. A 141, released January 9, 1901, caught January 30, 1901; No. W 48, released December 29, 1900, caught January 17, 1901; No. X 40, released December 31, 1900, caught January 14, 1901.

CHANGES IN WEIGHT AND SIZE OF TAGGED COD.

In the comparatively short time elapsing between the release and the capture of the tagged fish, but little opportunity has been afforded for obtaining data of much value on the rate of growth of the species. The records show a great irregularity in the changes in weight, some fish increasing inordinately, some but little, and some not at all.

The tagged fish recaptured were at liberty from 2 days to 15 months, the average time being 4 or 5 months. The number at large 6 months or more was 11. Only 3 fish were taken in the fall or winter succeeding release; one of these (No. 458), liberated January 31, 1898, was caught November 15, 1898; another (No. 880), liberated December 30, 1898, was caught November 1, 1899, and the third (No. A 870), released January 18, 1901, was caught in December, 1901. Only 1 fish was taken more than a year after release; this (No. C 95) was released February 3, 1899, and caught May 9, 1900.

In the case of the weight the basis for comparison is diminished in value by the poor condition of the fish at the time of release (owing to the loss of weight incident to captivity and the spawning condition) and by the questionable accuracy of the figures as submitted by the

fishermen. In many cases only the dressed weights of the fish have been reported, and in others the weights have simply been estimated or given in round numbers. In a small percentage of the fish the weights have been recorded with sufficient accuracy (sometimes by employees of the Fish Commission) to warrant the following comparisons, which must be considered in the light of the limitations referred to. In this table are given data for 40 specimens whose weight when captured is known or thought to have been stated with reasonable accuracy.

Among the most striking cases of increase in weight was that of the fish longest at liberty. It was a spent male, whose weight when released was 4 pounds, and when captured 15 months later was 7 pounds 8 ounces. Another noteworthy increase was that of an immature male weighing 3 pounds 8 ounces when released and 7 pounds when caught after 64 days.

Tag No.	Days at liberty.	Sex.	Weight when released.		Weight when recaptured.	
			Lbs.	*Oz.*	*Lbs.*	*Oz.*
315	125	Female, barren	4		7	
320	233	Male, barren	4		6	
400	77	Male, spent	4	8	5	
438	85	do	3	8	4	8
448	18	Female, spent	4		4	8
453	64	Female, barren	3	8	7	
495	90	do	5		5	8
511	45	Male, barren	4		7	3
512	103	do	4	8	5	12
533	41	do	4		4	13
863	108	Female, spent	5	8	6	
868	25	Male, spent	5		6	
888	20	Female, spent	4	8	6	8
921	204	Female, barren	4		7	
927	222	do	5	8	6	12
A 235	?128	Male, barren	5		7	
A 296	137	Female, spent	4	8	4	12
A 721	13	Male, barren	5		5	4
B 8	122	Female, barren	5		7	
B 89	62	do	5		6	
C 51	96	Female, spent	5	4	7	
C 69	111	Male, barren	5		6	8
C 95	460	Male, spent	4		7	8
C 98	143	do	7		8	
D 3	109	do	5	4	6	10
D 61	203	Male, barren	5	4	7	
D 82	65	do	4	8	5	8
G 35	108	Female, barren	3		4	
H 64	162	Male, barren	3	8	4	12
I 55	114	Male, spent	4		4	12
M 64	100	Female, barren	6		8	
M 81	92	Male, barren	4	6	6	
N 26	102	Female, barren	6		8	4
O 36	19	Male, barren	6	9	8	
S 10	18	do	4	9	5	12
S 43	13	do	4	9	5	4
S 98	89	Female, barren	4	6	5	4
T 32	74	Male, barren	6		7	
V 32	138	Male, spent	4	8	5	
W 81	25	Female, spent	3	8	3	9

NOTE.—The term "barren" is employed at the hatchery to designate fish which for any reason yielded no eggs or milt during the period of their captivity.

In forwarding tags a number of fishermen have referred to the condition of the fish, using such expressions as "a nice, plump fish," "fish in fine condition," "fish plump and healthy, tag has caused no sore," etc. On the other hand, many fish have been reported as "not healthy," "sore and thin," "rather thin," "in poor condition," "very thin fish,"

"poor and chafed," etc.; and there is undoubted evidence that in some cases the fish lost weight for a time after being released, and in other cases remained about stationary in this respect.

The following tabulation contains the record of 15 specimens illustrating these points:

Tag No.	Days at liberty.	Sex.	Weight when released.	Weight when recaptured.
			Lbs. Oz.	*Lbs. Oz.*
*261	91	Female, spent	4 8	4 2
337	32	Female, barren	5	4
†339	110	....do	5	5
360	13	....do	8	7 8
361	51	Male, barren	5 8	4 8
‡371	86	....do	4 8	4
469	109	....do	4 8	4
§483	43	Female, barren	5	5
‡851	141	Male, spent	6	6
922	37	Male, barren	6	5 12
987	11	Female, barren	4 8	4 8
A 606	15	Male, spent	6	5 4
D 41	74	Male, barren	5	4 10
*L 70	93	Female, spent	5	4
*V 40	185	Male, spent	5	5

* Fish reported as in poor condition.
† Fish reported as in good condition.
‡ Fish reported as sore and thin.
§ Fish reported as rather thin.

The following meager comparisons of length comprise about all the data obtained relating to this topic. The figures represent the length from end of snout to middle of posterior edge of caudal fin. The fish longest at liberty (C 95) increased 2½ inches in length, at the same time that it increased 3½ pounds in weight. In most cases the recorded increase, if any, was so small that it might have arisen from a different method of measuring.

Tag No.	Days at liberty.	Length when released.	Length when recaptured.	Increase in weight.
		Ft. In.	*Ft. In.*	
339	110	2 ⅛	2 1	No.
360	13	2 7	2 7	No.
438	85	2 1	2 1	Yes.
469	109	2 ⅛	2 ⅛	No.
495	90	2 2	2 3	Yes.
512	103	2 1	2 5⅛	Yes.
533	41	2 1	2 2	Yes.
851	141	2 3	2 3	No.
C 95	460	2 1⅛	2 4	Yes.
G 35	108	1 10	1 10⅝	Yes.
M 64	100	2 2	2 3⅛	Yes.

SIGNIFICANCE OF FAILURE TO CATCH TAGGED FISH IN SECOND, THIRD, AND FOURTH SEASONS AFTER RELEASE.

As has previously been shown, only a few cod were recaptured in the season following their release, and only one was taken more than a year after liberation. The failure to obtain information regarding the whereabouts of the tagged fish after the first season is one of the most interesting developments of the experiment.

Almost the first suggestion that occurs to one to account for this circumstance is the loss of the tags, either by erosion of the wire or tag, or by tearing loose from the fins. Reference has been made to

the unsatisfactory use of tags made of block tin—a substance employed in the first year of the tagging experiments. Of over 150 tin tags employed, only one was recovered, and it was so much worn by the action of the salt water that it would undoubtedly have fallen off or been completely eroded within a very short time. In the case of copper tags, however, there is not the slightest evidence that chemical action was sufficiently rapid or active to cause their loss. Tags recovered months after attachment had undergone practically no change except a slight diminution in luster, their edges being as clean and the figures as sharp as when first put in the water; and in no instances was there observable any general or irregular thinning of the copper wire by which the tags were made fast.

While it is probable that some tags have been lost by the gradual tearing of that part of the fin through which the wire passed, the available evidence fails to show that many tags could have been lost in this way. A considerable number of tags have been returned to the Commission either with the entire fish or with the fins to which they were attached. In none of these cases has there been any indication that the tag was in danger of being lost through tearing of the fin. Sometimes the fin was entirely healed around the wire, and sometimes a small slit in the interradial tissue had been formed by the movement of the tag. Very exceptionally a raw surface existed around the wire, and the fishermen occasionally reported that the wire had made a small sore in the fin.

It is clearly evident that the explanation of the point under consideration lies not in the tags but with the fish themselves, although what the real explanation is can only be surmised.

Mention has been made of the curious absence of tagged fish from the Nantucket Shoals in fall and winter, at a time when very active fishing is going on, and when the tagged fish were originally caught on these same grounds. It is possible that when the Nantucket Shoals cod have attained a certain age they cease to resort there, at least in fall and winter, and seek other grounds at that season, perhaps going to the offshore banks, where, becoming more widely dispersed and mixing with a larger body of fish, they are less likely to be caught than in the shore waters. This supposition carries with it the suggestion that the cod frequenting the Nantucket Shoals each fall and winter go there for the purpose of spawning, and represent new schools of fish that have perhaps come in from the offshore grounds.

The data on which to base deductions are obviously too meager.

THE LARGE PERCENTAGE OF TAGGED FISH CAUGHT.

The fact that about 4 per cent of the fish tagged and released were subsequently captured by the commercial fishermen raises several important questions. It must be conceded that this is an unexpectedly large proportion, when the abundance of cod on our shores and the wide

extent of the region involved are considered. There is little doubt, furthermore, that the fish retaken represented even more than 4 per cent of the available supply of tagged fish, because it is regarded as reasonably certain that some of the released specimens must, shortly after liberation, have necessarily succumbed to the effects of prolonged captivity; and, as has been shown, nearly 4 per cent of the tags used were such that their loss through natural agencies was likely.

The question naturally arises, Were there any reasons why these tagged fish should be taken in relatively larger numbers than wild, untagged fish? And to this question an affirmative answer can probably be made with safety.

When released, the tagged fish were for the most part thin and hungry, owing to captivity, spawning, and deficiency of food. It is therefore not unreasonable to expect that at first they fed with less caution than is normally exercised. But the acute hunger of a fish in a region of plenty is quickly appeased; and too large a percentage of the tagged fish were caught long after their liberation to warrant the belief that mere inordinate hunger resulting from their captivity could have been an important factor.

A more probable factor in their capture was the partial domestication arising from 2 to 4 months of captivity with artificial feeding, and the lowered vitality resulting from captivity, handling, spawning, and unaccustomed food. These conditions would undoubtedly have resulted in a loss of acumen in avoiding danger and in capturing natural food, and would have made the tagged fish less cautious in taking the bait offered by the fishermen.

While the known facts are entirely too meager to warrant sweeping conclusions on any of the points involved, it may not be uninteresting or altogether unprofitable to speculate as to the available cod supply in the region frequented by the tagged fish.

Excluding the extensive fishing done on Georges Bank and in the South Channel, where only two of the tag-bearing cod were captured, it appears from the official statistics that the average annual catch of cod between southern Massachusetts and southern New Jersey is about 20,000,000 pounds. The weight of the tagged fish released during four years was nearly 20,000 pounds, or about 5,000 pounds annually; and the aggregate weight of the tagged fish caught was approximately 805 pounds, or 200 pounds each year. From the foregoing data it appears that if the same proportion prevailed for the entire catch of wild fish as for the tagged fish, the available annual supply of cod on the grounds in question is 500,000,000 pounds, thus:

$$\left.\begin{array}{l}\text{5,000 (the available quantity of tagged fish)}\end{array}\right\} : \left\{\begin{array}{c}x \\ \text{(the available supply of wild fish)}\end{array}\right\} = \left\{\begin{array}{l}\text{200 (the annual catch of tagged fish)}\end{array}\right\} : \left\{\begin{array}{l}\text{20,000,000 (the annual catch of wild fish).}\end{array}\right.$$

$$x = 500{,}000{,}000.$$

For the reasons stated it is probable that a smaller percentage of wild fish than of tagged fish is taken, and consequently the foregoing amount does not adequately represent the real abundance of cod on our shores.

MISCELLANEOUS INFORMATION AFFORDED BY THE EXPERIMENTS.

Among a mass of voluntary information furnished by cod fishermen in connection with the return of tags, some notes have been received which are not without interest.

From a number of sources it has been reported that the shore cod, which, on account of their small size, abundance in the inshore waters, and occurrence on grounds not formerly resorted to, the fishermen have come to look on as artificially-hatched fish, have at certain seasons been found to be feeding to a considerable extent on small lobsters. It was not possible to verify all of these reports, but in a few cases some of the young lobsters ejected by the cod when caught have been examined by the agents of the Commission. Writing from Nantucket under date of November 21, 1900, Mr. R. C. Small, who has taken great interest in the tagging experiments and forwarded many tags from Nantucket, said:

> The school of cod off here are destroying a great many small lobsters. I have sent some of the lobsters taken from the pokes of the fish. I have found as many as four 3-inch lobsters in one cod. The fish throw them out after being taken into the boat.

The following interesting notes on the abundance and food of cod at the extreme southern limit of the cod fishery have been communicated by Capt. D. C. Clark, of Atlantic City, N. J.:

> *January 31, 1901.*—We are catching cod with herring (i. e., alewives) and menhaden in them partly digested.
>
> *February 15, 1901.*—Cod have been quite plentiful off these grounds this fall and winter up to about New Year's, when, as usual, they leave here and do not return till March, when apparently the same run of fish comes back. I am under the impression that they go south or away offshore, because we have gone 25 miles straight offshore from Absecon Light and have found no more or larger fish than inshore, say from 10 to 12 miles. So if they move offshore they must go a considerable distance, otherwise they must go south; and I am inclined to the latter view, as once in March I took as many as five croakers out of a large cod, two or three of them almost digested and the rest partly digested. One of them was but very little changed; it looked to me as if it might have been swallowed about three or four hours. We do not catch croakers here till late in the spring, say May or June. Now, the cod must travel very fast or the croakers must be nearer than we know. At this time of the year the cod we catch here are full of silversides and sand crabs; occasionally a small flounder or black-fish is to be found in them, but lately they have been unusually full of silversides. I think cod are no more abundant this winter than formerly. Of course, there are times when they are more plentiful than others, and some winters they are scarcer than others, but on the whole I think they are about the same this winter as they were last winter.
>
> Haddock have been more plentiful here this winter than ever they were before. We have also caught more pollock than ever before, having taken some dozen or more. Previous to this time we never caught more than one or two in a season.

Cod fishing has been done here for the last 15 or 20 years to a certain extent, and for the last 4 or 5 years there have been from 30 to 100 men engaged all winter through, with from 15 to 25 boats of all descriptions, some having 3 men and some 7. They all quit about the middle of March, with the exception of myself and one or two more. We find occasional herring and menhaden in cod all the winter through.

To give you some idea of the number of fish running along here at the different times of the year, from November to Christmas a boat with 5 men fishing 5,000 hooks a day will catch from 600 to 1,200 fish. The same rig from Christmas to March will catch from 100 to 500 fish. After that time they become quite plentiful again, but the dog sharks are so thick that you can not do much.

April 14, 1901.—Cod have been rather scarce this spring on the Jersey coast. Dog sharks have commenced to be quite numerous, and this will about end the cod fishing. We are catching quite a number of cod with large roe about ready to be thrown off, and we find an occasional menhaden in them.

June 10, 1901.—None of the tagged fish we caught had any spawn in them. In fact, after Christmas only an occasional cod, perhaps a dozen in 200 or 300, will have spawn, while before Christmas half of them will be spawn fish.

Mr. R. C. Small reported from Nantucket in November, 1900, that—

The fishermen have not seen a single tag during this season's fishing, nor did they in 1899 after the spring catch. Of course, they fish here until late in December, and if anything turns up I will inform you at once. The cod are running rather small, that is, there are a great many 2 and 2½ feet, but they seem to school by themselves, and the fishermen shift from time to time to get better size.

While most of the tagged fish were taken on lines, quite a number were caught in fixed appliances. Perhaps a dozen were secured in trap or pound nets in New Jersey, Rhode Island, and Massachusetts, and one was caught in a lobster pot in Connecticut. A fish taken in a pound net off Seagirt, N. J., contained an alewife 8½ inches long and four cockles (*Lunatia*).

In April, 1901, a remarkable piebald cod, taken off Race Point, Massachusetts, was sent to the Commission. It weighed 10 pounds, and was apparently normal in all respects except as to color. The usual greenish-brown ground color and brown spots were lacking over nearly the entire body, and irregular blotches of creamy white and bright orange predominated on body and head. The fins were marked by white, orange, dull red, and greenish-black streaks, for the most part parallel with the rays. The iris was dark.

NOTES ON THE FISHES OF LAKE ONTARIO.

By Barton Warren Evermann and William C. Kendall.

During the summer of 1894 a considerable collection of fishes was made in northern New York for the United States Fish Commission by Dr. Evermann, assisted by Dr. R. R. Gurley, Mr. Barton A. Bean, and Mr. R. H. Hinkley, jr. The larger part of the collection was obtained in Lake Ontario or from streams tributary to it. Since then various small collections have been received from time to time from the same region. The principal localities represented are as follows: Cape Vincent, Watertown, Sacketts Harbor, Chaumont Bay, Oswego, Charlotte, Point Breeze, Nine-mile Point, Pultneyville, Great Sodus Bay, Henderson Bay, Selkirk, North Hamlin, Buena Vista, Belleville, and Pulaski. The localities visited in the vicinity of Cape Vincent were Grenadier Island, Mud Creek, and various places in the lower end of the lake.

In the present paper is given a list of the 66 species obtained in Lake Ontario and the streams tributary to it, together with notes on their relative abundance and any structural peculiarities noticed. Seven other species not obtained by these collectors are included because they are of special interest and have been previously recorded from the lake. The list embraces 73 species, and is of value in showing the distribution and abundance of the various species in this part of the State.

1. Acipenser rubicundus Le Sueur. *Lake Sturgeon.*

Not uncommon in the east end of the lake. Numerous specimens seen at Cape Vincent.

2. Lepisosteus osseus (Linnæus). *Bill-fish.*

Seen at Cape Vincent and Sacketts Harbor; doubtless common throughout the lake and its larger tributaries.

3. Amia calva Linnæus. *Bowfin.*

Not obtained by us, but previously recorded from Lake Ontario. It is probably not uncommon in the lake.

4. Ictalurus punctatus (Rafinesque). *Channel Cat.*

One specimen obtained at Fox Island June 29; not noticeably different from Mississippi River specimens.

5. Ameiurus nebulosus (Le Sueur). *Common Bullhead.*

This fish is abundant in nearly all the waters examined. Specimens are in the collection from the following places: Stony Creek near Henderson Harbor; Black River at Huntingtonville; Cemetery Creek near Watertown; Mud Creek near Cape Vincent; Chaumont River; Guffon Creek near Chaumont; Stony Island near Lakeview Hotel, 7 miles northeast of Oswego; mouth of Salmon River; mouth of Little Salmon Creek; creek at Pultneyville; Four-mile Creek at Nine-mile Point; Marsh Creek near Point Breeze; Long Pond near Charlotte; and Sandy Creek at North Hamlin.

6. Ameiurus melas (Rafinesque). *Black Bullhead.*

Much less common than the preceding. Specimens only from Mill Creek near Sacketts Harbor and Sandy Creek near North Hamlin.

7. Noturus flavus (Rafinesque). *Yellow Cat.*

Apparently not common; only two specimens from Nine-mile Point.

8. Schilbeodes gyrinus (Mitchill). *Mad Tom.*

Not common; obtained only in Mill Creek near Sacketts Harbor, Guffon Creek near Chaumont, and Long Pond near Charlotte.

9. Schilbeodes miurus (Jordan). *Mottled Mad Tom.*

Rare; obtained only from Sandy Creek at North Hamlin.

10. Catostomus catostomus (Forster). *Long-nosed Sucker.*

Not uncommon; several fine specimens obtained in gill nets near Grenadier Island. One of the most important food-fishes of the family. Among the suckers of Lake Ontario this species may always be known by its long nose, fine scales, and red sides.

11. Catostomus commersonii (Lacépède). *Common White Sucker.*

Common everywhere, and numerous specimens obtained, representing the following localities: Cape Vincent; Grenadier Island; Sacketts Harbor; Mill Creek near Sacketts Harbor; Little Stony Brook; Henderson Bay; Cemetery Creek near Watertown; Guffon Creek, Chaumont; Big Sandy Creek at Belleville; Spring Brook and Wart Creek, Pulaski; mouth of Salmon River at Selkirk; Three-mile Creek, Oswego; Four-mile Creek and Salt Brook at Nine-mile Point; Marsh Creek at Point Breeze.

12. Erimyzon sucetta oblongus (Mitchill). *Chub Sucker.*

This sucker was found only in Black Creek, tributary to Oswego River.

13. Moxostoma anisurum (Rafinesque). *White-nosed Sucker.*

Specimens obtained at Fox Island and Point Breeze. These specimens differ from the descriptions in having the lower lip rather lunate than V-shaped or U-shaped. Head 4; depth 3.14; eye 5; cheek 3; D. 16; A. 7; scales 6–42–5.

14. Moxostoma aureolum (Le Sueur). *Redhorse.*

Specimens from the lake near Oswego; near Nine-mile Point; mouth of Salmon River; Long Pond at Charlotte; Sandy Creek at North Hamlin. This is a common species in the lake.

15. Campostoma anomalum (Rafinesque). *Stone-roller.*

Common in many places. Found in creek at Pultneyville; Salt Brook near Nine-mile Point; Long Pond at Charlotte; and Marsh Creek at Point Breeze.

16. Chrosomus erythrogaster Rafinesque. *Red-bellied Dace.*

Cemetery Creek near Watertown; Salt Brook near Nine-mile Point; Long Pond at Charlotte.

17. Hybognathus nuchale Agassiz. *Silvery Minnow.*

Mill Creek near Sacketts Harbor; Salt Brook near Nine-mile Point; and Cemetery Creek near Watertown.

18. Pimephales promelas Rafinesque. *Fathead Minnow.*

Obtained in Three-mile Creek at Oswego; Mill Creek near Sacketts Harbor; and Salt Brook near Nine-mile Point.

19. Pimephales notatus (Rafinesque). *Blunt-nosed Minnow.*

Abundant; specimens obtained at Cape Vincent; Mud Creek near Cape Vincent; Grenadier Island; Horse Island; Sacketts Harbor; Mill Creek near Sacketts Harbor; Stony Island; Little Stony Brook; Henderson Bay; Black River at Huntingtonville; Guffon Creek, Chaumont Bay; Chaumont River; Marsh Creek near Point Breeze; Salt Brook near Nine-mile Point; and Long Pond at Charlotte.

20. Semotilus corporalis (Mitchill). *Fall-fish.*

Not common. Cape Vincent; Big Stony Creek, Henderson Harbor; Wart Creek near Centerville; Salmon River near Selkirk; Sandy Creek near North Hamlin.

21. Semotilus atromaculatus (Mitchill). *Creek Chub.*

Very common. Specimens from Mill Creek near Sacketts Harbor; Big Stony Creek at Henderson Harbor; Little Stony Brook at Henderson Bay; Cemetery Creek near Watertown; Big Sandy Creek at Belleville; Wart Creek at Centerville; Three-mile Creek at Oswego; Four-mile Creek at Webster; Salt Brook near Nine-mile Point; and Long Pond at Charlotte.

22. Leuciscus elongatus (Kirtland.) *Red-sided Minnow.*

Found only in Wart Creek; Spring Brook at Pulaski; and Three-mile Creek at Oswego. This is the first record of this minnow for the State of New York.

23. Leuciscus margarita (Cope). *Pearly Minnow.*

Thirteen specimens of a minnow we identify with this species were obtained in Cemetery Creek near Watertown, July 5. They give the following comparative measurements: Head 4; depth 4.4; eye 3.5; D. 9; A. 9; teeth 2, 5–6, 1 or 1, 5–4, 0; scales 11–58–6.

24. Abramis crysoleucas (Mitchill). *Roach.*

Common. Cape Vincent; Grenadier Island; Black River at Huntingtonville; Guffon Creek, Chaumont; Chaumont River; Black Creek at Scriba Corner; Salmon River at Selkirk; and Salt Brook near Nine-mile Point.

25. Notropis cayuga Meek. *Cayuga Minnow.*

Common. Mud Creek near Cape Vincent; Mill Creek near Sacketts Harbor; Cemetery Creek near Watertown; Guffon Creek near Chaumont; Chaumont River; Black Creek at Scriba Corner; Little Salmon Creek; Three-mile Creek near Oswego; Great Sodus Bay; Four-mile Creek at Nine-mile Point.

This interesting little minnow, originally described from Cayuga Lake, is now found to be quite abundant throughout western New York.

26. Notropis heterodon (Cope). *Black-chin Minnow.*

Found in the lake near Cape Vincent, at Stony Island, and in Guffon Creek at Chaumont. Teeth 1, 4–4, 0, in specimen examined.

27. Notropis blennius (Girard). *Straw-colored Minnow.*

A common minnow. Cape Vincent; Grenadier Island; Little Stony Brook at Henderson Bay; Big Sandy Creek at Belleville; Salmon Bay at Selkirk; and Great Sodus Bay. This species is one of the smallest minnows, too small for use as bait.

28. Notropis hudsonius (Clinton). *Spot-tail Minnow.*

An abundant and important minnow. Obtained at the following places: Cape Vincent; Grenadier Island; Horse Island; Sacketts Harbor; Salmon River at Selkirk; Little Salmon Creek; Three-mile Creek at Oswego; Long Pond and lake at Charlotte; Great Sodus Bay; and Salt Brook near Nine-mile Point. This is one of the most useful bait minnows in the State; called "Shiner" at Cape Vincent and elsewhere. On June 28 we saw a very large school of this minnow at the head of Grenadier Island. They were swimming at a depth of 6 to 18 inches below the surface in water 3 feet deep, and in a very compact body. There were apparently several thousand in the school. Several that we caught were full of ripe spawn. They were believed to be young white-fish by a local fisherman.

29. Notropis whipplii (Girard). *Satin-fin Minnow.*

Quite common. Found at the following localities: Cape Vincent; Grenadier Island; Horse Island at Sacketts Harbor; Mill Creek near Sacketts Harbor; Cemetery Creek near Watertown; Chaumont River; Great Sodus Bay and creek near Pultneyville.

30. Notropis cornutus (Mitchill). *Redfin Shiner.*

Very abundant, and found at nearly all places where collections were made. Mud Creek near Cape Vincent; Mill Creek near Sacketts Harbor; Big Stony Creek and Little Stony Brook at Henderson Harbor; Black River at Huntingtonville; Big Sandy Creek at Belleville; Black Creek at Scriba Corner; Spring Brook at Pulaski; Wart Creek near Buena Vista; Three-mile Creek at Oswego; Marsh Creek at Point Breeze; creek at Pultneyville; Four-mile Creek at Nine-mile Point; Salt Brook near Nine-mile Point; Long Pond at Charlotte; and Sandy Creek at North Hamlin.

These specimens have the snout short; 16 scales before the dorsal in the Sandy Creek specimens.

31. Notropis atherinoides Rafinesque. *Slender Minnow.*

Not common. Obtained only at Cape Vincent and Grenadier Island. Head 4.5 to 5; depth 5 to 5.5; eye 3.25; D. 8; A. 11 to 13; scales 6–38 to 42–2 or 3; teeth 2, 4–4, 2; 20 or 21 scales before the dorsal.

32. Notropis rubrifrons (Cope). *Red-fronted Minnow.*

Not very common. Obtained only in Mill Creek near Sacketts Harbor; Salt Brook near Nine-mile Point; Wart Creek near Buena Vista; and Sandy Creek near North Hamlin.

33. Rhinichthys atronasus (Mitchill). *Black-nosed Dace.*

Very abundant everywhere. Mud Creek at Cape Vincent; Horse Island; Stony Island; Little Stony Brook at Henderson Bay; Black River at Huntingtonville; Big Sandy Creek at Belleville; Mill Creek at Pulaski; Wart Creek near Buena Vista; Three-mile Creek at Oswego; Great Sodus Bay; Four-mile Creek near Webster; Salt Brook near Nine-mile Point; Long Pond at Charlotte.

34. Hybopsis storerianus (Kirtland). *Storer's Minnow.*

Found only in Long Pond at Charlotte, where but three specimens were obtained.

35. Hybopsis kentuckiensis (Rafinesque). *River Chub.*

Not seen by us, but reported by Dr. H. M. Smith as being very common.

36. Exoglossum maxillingua (Le Sueur.) *Split-lip Minnow.*

This curious and interesting species was obtained at 7 localities, as follows: Big Stony Creek at Henderson Harbor; Little Stony Brook at Henderson Bay; Black River at Huntingtonville; Big Sandy Creek at Belleville; Spring Brook at Pulaski; Wart Creek near Buena Vista; Salmon River at Selkirk.

37. Anguilla chrysypa (Rafinesque). *Common Eel.*

Not seen by us, but common as far as Niagara Falls.

38. Pomolobus pseudoharengus (Wilson). *Alewife.*

Cape Vincent; Grenadier Island; Salmon River at Selkirk; lake and Long Pond at Charlotte.

During June and July, 1894, this fish was found dead in considerable numbers at all places visited in the eastern part of the lake.

[**Alosa sapidissima** (Wilson). *Common Shad.* Shad were planted in Lake Ontario in 1870, 1871, 1872, 1873, 1877, and 1878. A few only of these survived, and since 1885 few, if any, have been seen.]

39. Coregonus clupeiformis (Mitchill). *Common White-fish.*

As the time of our visit to Lake Ontario was not the fishing season for this species, but few specimens were seen. It was seen at Cape Vincent, but we are not sure where the specimens came from.

40. Argyrosomus artedi (Le Sueur). *Lake Herring or Cisco.*

Seen only at Cape Vincent and Grenadier Island. The specimens seen were caught in gill nets on Charity Shoal in 140 to 160 feet.

41. Argyrosomus prognathus (H. M. Smith). *Long-jaw White-fish.*

Numerous specimens seen at Grenadier Island which had been taken June 28 in gill nets on Charity Shoal, 6 miles off Grenadier Island and near Duck Island, in 140 to 160 feet. Others were obtained by Dr. Gurley, August 26, at Wilson. They had been caught in gill nets about 3 miles off, in 105 fathoms.

42. Salmo salar Linnæus. *Atlantic Salmon.*

Though at one time a common fish in some of the tributaries of this lake, but few have been seen in recent years. None was seen by us.

43. Cristivomer namaycush (Walbaum).* *Lake Trout.*

None seen by us, but ocasionally taken.

44. Umbra limi (Kirtland). *Mud Minnow.*

Apparently not common, specimens having been obtained only in Mill Creek near Sacketts Harbor and Guffon Creek near Chaumont.

45. Lucius vermiculatus (Le Sueur). *Grass Pike.*

Rather common in all suitable waters. Black Creek at Scriba Corner; Lakeview west of Oswego; Wart Creek near Buena Vista; Great Sodus Bay; outlet of Long Pond near Charlotte; and Marsh Creek near Point Breeze.

46. Lucius reticulatus (Le Sueur). *Common Pickerel.*

Found only in Black River at Huntingtonville, where two specimens were obtained.

47. Lucius lucius (Linnæus). *Common Pike.*

Mud Creek near Cape Vincent; Chaumont River; and Long Pond near Charlotte. Doubtless common in all suitable places.

48. Fundulus diaphanus (Le Sueur). *Grayback.*

Generally abundant in the lake. Mud Creek near Cape Vincent; Grenadier Island; Horse Island at Sacketts Harbor; Mill Creek near Sacketts Harbor; Stony Island;

---

* *Thymallus ontariensis* Cuvier & Valenciennes, Hist. Nat. Poiss., XXI, 452, 1848, was based upon a specimen of grayling said to have been brought by Milbert from Lake Ontario, but it certainly did not come from Lake Ontario. It was probably the ordinary European grayling, *Thymallus thymallus*.

Little Stony Brook at Henderson Bay; Guffon Creek and Chaumont River near Chaumont; Great Sodus Bay; Long Pond near Charlotte.

49. Eucalia inconstans (Kirtland). *Brook Stickleback.*

Common in suitable places. Cape Vincent; Mill Creek near Sacketts Harbor; Black River at Huntingtonville; Three-mile Creek near Oswego; Four-mile Creek at Nine-mile Point; Salt Brook near Nine-mile Point; Long Pond near Charlotte.

50. Gasterosteus bispinosus Walbaum. *Common Stickleback.*

Not common. Found only at Grenadier Island, Horse Island, and in Salt Creek near Nine-mile Point. These seem to be the first records of the occurrence of this salt-water fish in the Great Lakes.

51. Percopsis guttatus Agassiz. *Trout Perch.*

Probably not uncommon in the lake, but specimens were obtained only at Cape Vincent, Grenadier Island, and Nine-mile Point. Several specimens were found dead.

52. Labidesthes sicculus (Cope). *Skipjack.*

Probably common in the lake. Stony Island; Great Sodus Bay; Long Pond at Charlotte, and Sandy Creek at North Hamlin. No large schools were seen.

53. Pomoxis sparoides (Lacépède). *Calico Bass.*

Found only in Long Pond near Charlotte.

54. Ambloplites rupestris (Rafinesque). *Rock Bass.*

Common everywhere. Cape Vincent; Grenadier Island; Mill Creek near Sacketts Harbor; Little Stony Brook at Henderson Bay; Cemetery Creek near Watertown; Guffon Creek near Chaumont; Chaumont River; Salmon River and Little Salmon Creek; Black Creek near Scriba Corner; Great Sodus Bay; Salt Brook near Nine-mile Point; Sandy Creek near North Hamlin; Marsh Creek near Point Breeze.

55. Lepomis pallidus (Mitchill). *Bluegill.*

Doubtless common, but actually obtained only at Stony Island off Sacketts Harbor.

56. Eupomotis gibbosus (Linnæus). *Pumpkin Seed.*

Very abundant and found at nearly every place where collections were made. Mud Creek and lake near Cape Vincent; Grenadier Island; Horse Island; Stony Island; Big Stony Creek at Henderson Harbor; Cemetery Creek near Watertown; Black River at Huntingtonville; Guffon Creek and Chaumont River near Chaumont; Black Creek near Scriba Corner; Lakeview near Oswego; Little Salmon Creek and Salmon River; Three-mile Creek near Oswego; Great Sodus Bay; creek at Pultneyville; Four-mile Creek at Nine-mile Point; Long Pond near Charlotte; Sandy Creek near North Hamlin; Marsh Creek at Point Breeze.

57. Micropterus dolomieu Lacépède. *Small-mouth Black Bass.*

An abundant and important game-fish. Numerous examples from 3 to 12 inches long seen in a cove on Grenadier Island. It was doubtless seen elsewhere, but no specimens were retained.

58. Micropterus salmoides (Lacépède). *Large-mouth Black Bass.*

Common everywhere. Cape Vincent; Grenadier Island; Stony Island; Chaumont River; Salmon River and Little Salmon Creek; Three-mile Creek at Oswego; Great Sodus Bay; creek at Pultneyville; Four-mile Creek at Nine-mile Point; Long Pond at Charlotte; Marsh Creek at Point Breeze, and Lakeview.

59. Stizostedion vitreum (Mitchill). *Wall-eyed Pike.*

Cape Vincent, Oswego River, and Point Breeze. An abundant and valued food-fish. Usually called "yellow pike" on this lake. Various vernacular names for the wall-eyed pike are heard among fishermen and anglers, among which may be mentioned blue pike, yellow pike, doré, and jack salmon, the last an absurd name in use in various places in Indiana, Kentucky, and Tennessee. "Pike perch" is a book name largely in use by fish-culturists and in the publications of the United States Fish Commission.

60. Stizostediun canadense (Smith). *Sauger.*

Not seen by us, but occasionally taken, especially about Chaumont Bay.

61. Perca flavescens (Mitchill). *Yellow Perch.*

Abundant everywhere. Cape Vincent; Grenadier Island; Stony Island; Little Stony Brook at Henderson Bay; Chaumont River; Black Creek near Scriba Corner; Little Salmon Creek and Salmon River; creek at Pultneyville; Great Sodus Bay; Four-mile Creek and Salt Brook near Nine-mile Point; Lakeview and Three-mile Creek near Oswego; Long Pond near Charlotte.

62. Percina caprodes zebra (Rafinesque). *Log Perch.*

Common in all suitable places. Grenadier Island; Cape Vincent; Horse Island; lake at Nine-mile Point; Little Salmon Creek; Salmon River near Selkirk; and Marsh Creek near Point Breeze.

63. Hadropterus aspro (Cope & Jordan). *Black-sided Darter.*

Found only in Marsh Creek, near Point Breeze, where three specimens were obtained. These have the scales 9–68–11, 9–65–11, and 9–65–11, respectively.

64. Diplesion blennioides (Rafinesque). *Green-sided Darter.*

Three specimens obtained in Sandy Creek at North Hamlin.

65. Boleosoma nigrum olmstedi (Storer). *Olmsted's Darter.*

Cape Vincent and Mud Creek near Cape Vincent; Horse Island; Grenadier Island; Mill Creek near Sacketts Harbor; Stony Island; Little Stony Brook at Henderson Bay; Cemetery Creek near Watertown; Guffon Creek and Chaumont River near Chaumont; Spring Brook near Pulaski; Salmon River; Little Salmon Creek; Three-mile Creek near Oswego; Great Sodus Bay; Long Pond near Charlotte; Sandy Creek near North Hamlin.

66. Etheostoma cœruleum Storer. *Rainbow Darter.*

Found by us only in Marsh Creek near Point Breeze, and Salt Brook near Nine-mile Point.

67. Etheostoma flabellare Rafinesque. *Fan-tailed Darter.*

Quite common and well distributed throughout the western part of the State. Numerous specimens obtained at the following places: Grenadier Island; Horse Island: Mill Creek near Sacketts Harbor; Little Stony Brook at Henderson Bay; Cemetery Creek near Watertown; Chaumont River; Big Sandy Creek near Belleville; Spring Brook near Pulaski; Wart Creek near Buena Vista; Three-mile Creek near Oswego; Great Sodus Bay; Four-mile Creek and Salt Brook near Nine-mile Point; Sandy Creek near North Hamlin; Marsh Creek near Point Breeze.

68. Boleichthys fusiformis (Girard). *Fusiform Darter.*

Obtained only in Mud Creek near Cape Vincent at Grenadier Island and in Guffon Creek near Chaumont. Head 4; depth 5.5; D. IX–11; A. II 8; scales 5–57–9; specimen 2.25 inches long, from Mud Creek.

69. Roccus chrysops (Rafinesque). *White Bass.*

Found by us only at Horse Island, Sacketts Harbor, where three examples were obtained June 30. Published reference to the occurrence of *Roccus lineatus* in this lake are all probably based upon specimens of this species.

70. Aplodinotus grunniens Rafinesque. *Fresh-water Drum or Sheepshead.*

Seen only at Point Breeze, where one specimen was obtained from the lake.

71. Cottus ictalops (Rafinesque). *Common Blob.*

Specimens obtained at Grenadier and Stony islands.

72. Triglopsis thompsoni Girard. *Deep-water Blob.*

Three specimens from Nine-mile Point, one from the lake, the two others from a small creek.

73. Lota maculosa (Le Sueur). *Ling.*

One specimen obtained 4 miles off Nine-mile Point.

AN ANNOTATED LIST OF THE FISHES KNOWN TO OCCUR IN LAKE CHAMPLAIN AND ITS TRIBUTARY WATERS.

By Barton Warren Evermann and William Converse Kendall.

This paper is based primarily upon observations and collections made in the Lake Champlain basin in July, 1894, by the senior writer of this article and Mr. Barton A. Bean, of the United States National Museum. At that time collections were made at Rouses Point, in Missisquoi Bay, at Alburg Springs, on the west shore of Hog Island, in Saranac River near Plattsburg, and in Scioto Creek near Coopersville, N. Y. Subsequently a small collection was received by the Fish Commission from Mr. A. L. Collins, of Swanton, Vt.; another considerable collection from Mr. John W. Titcomb, of St. Johnsbury, Vt., made by him in Caspian Lake, at the headwaters of Lamoille River, November 10, 1898, and a few specimens have been received from various other sources, among them a small collection made by Dr. Evermann in Upper Saranac Lake, in 1901.

To make the list complete and more useful as a faunal catalogue, we have included all species known to us to inhabit Lake Champlain or its tributary waters. We have aimed to include all references of which we have found any definite record and a bibliography of the papers in which they occur. The titles are arranged chronologically. Under each is given a list of the species mentioned in it, the page upon which the record occurs, and our identification of each species in current nomenclature. In the formal list of species reference is made to the authority for the record.

The total number of species known to inhabit the Lake Champlain basin is only 54. Doubtless this list will be considerably enlarged whenever its waters are more thoroughly studied. As a matter of fact only the most desultory collecting has been done either in the lake or its tributaries. Practically nothing has ever been published concerning the fishes of the great multitude of small lakes and streams in the Adirondacks, many of which are tributary to Lake Champlain; and, Zadock Thompson's list excepted, but little has been published even of the fishes inhabiting the lake itself. In 1896 the present writers published a list of the fishes known from the State of Vermont.[a] The total number of species included was 53, 45 of which were from the Lake Champlain basin. The present paper adds 9 species to the Champlain list.

[a] An annotated list of the fishes known from the State of Vermont. <Report U. S. Fish Commission for 1894 (1896), 579-604.

BIBLIOGRAPHY.

1817. Rafinesque, C. S.—Museum of Natural Sciences; first decade of new North American fishes. <American Monthly Magazine and Critical Review, 1817, 118–121.

Page.	Nominal species.	Identification.
120	Anguilla chrysypa*	Anguilla chrysypa.
120	Salmo pallidus*	Cristivomer namaycush.
121	Cyprinus hemiplus*	Abramis crysoleucas.

1817. Le Sueur, C. A.—A new genus of fishes, of the order *Abdominales*, proposed under the name of *Catostomus;* and the characters of the genus, with those of its species, indicated. <Journal Academy of Natural Sciences Philadelphia 1817, 102–111.

Page.	Nominal species.	Identification.
102	Catostomus* longirostrum*	Catostomus catostomus.

1818. Rafinesque, C. S.—Description of three new genera of fluviatile fish, *Pomoxis*, *Sarchirus*, and *Exoglossum*. <Journal of the Academy of Natural Sciences Philadelphia 1818, 417–422.

Page.	Nominal species.	Identification.
422	Exoglossum* nigrescens*	Exoglossum maxillingua.

1820. Rafinesque, C. S.—Annals of Nature, or annual synopsis of new genera and species of animals, plants, etc., discovered in North America. 1, 1820, 1–16.

Page.	Nominal species.	Identification.
6	Hemiplus lacustris*	Abramis crysoleucas.

1842. De Kay, James E.—Natural History of New York: Fishes. i–xv and 1–415, pls. 1–79, 1842.

Page.	Nominal species.	Identification.
209	Leuciscus nitidus*	Semotilus corporalis.
220	Hydrargyra atricauda*	Umbra limi.
383	Ammocœtes unicolor*	Ichthyomyzon concolor.

*New genera and species are indicated by *.

1842. THOMPSON, ZADOCK.—History of Vermont, natural, civil, and statistical, in three parts, with a new map of the State, and 200 engravings, IV+648, 1842. Part I is entitled "Natural History of Vermont," and comprises pages 1 to 224, pages 1 to 151 being devoted to the fishes.

Page.	Nominal species.	Identification.
129	Perca serrato-granulata	Perca flavescens.
130	Lucio-Perca americana	Stizostedion vitreum.
130	Pomotis vulgaris	Eupomotis gibbosus.
131	Centrarchus æneus	Ambloplites rupestris.
132	Etheostoma caprodes	Percina caprodes.
133	Corvina oscula	Aplodinotus grunniens.
133	Catostomus cyprinus	Carpiodes thompsoni.
134	Catostomus oblongus	Moxostoma aureolum.
134	Catostomus teres	Catostomus commersonii.
135	Leuciscus pulchellus	Semotilus corporalis.
136	Leuciscus crysoleucas	Abramis crysoleucas.
136	Leuciscus atronasus	Rhinichthys atronasus.
137	Hydrargyra fusca*	Umbra limi.
137	Esox estor	Esox lucius.
138	Pimelodus vulgaris*	Ameiurus vulgaris.
139	Pimelodus, sp	Ameiurus lacustris.
140	Salmo salar	Salmo salar.
140	Salmo namaycush	Cristivomer namaycush.
142	Osmerus eperlanus	Osmerus mordax.
143	Coregonus albus	Coregonus clupeiformis.
144	Hiodon clodalus	Hiodon tergisus.
145	Lepisosteus oxyurus	Lepisosteus osseus.
145	Lepisosteus lineatus*	Lepisosteus osseus (young).
146	Lota maculosa	Lota maculosa.
149	Acipenser rubicundus	Acipenser rubicundus.
149	Acipenser oxyrhynchus	Do.
150	Ammocœtes concolor	Ichthyomyzon concolor.

1849. THOMPSON, ZADOCK.—Notes on certain Vermont fishes. <Proceedings of the Boston Society of Natural History, III, 1848–1851 (July 18, 1849), 1851, 163–165.

In this communication Mr. Thompson described the supposed new species *Esox nobilior*, which is identical with *Esox masquinongy*, and another species which he supposed to be new, under the name *Percopsis pellucida*, and suggested that this last might represent a new genus, for which he would propose the name *Salmoperca*.

1850. BAIRD, SPENCER F.—A small collection of fishes was made by Professor Baird at Westport, N. Y., in Lake Champlain, in 1850, which are catalogued in the record books of the department of fishes of the U. S. National Museum, referred to in this paper as "Baird coll. 1850."

Cat. No.	Species as recorded.	Identification.
1487	Pimelodus atrarius	Ameiurus nebulosus.
1488	Ameiurus nebulosus	Do.
1489	....do	Do.
1490	....do	Do.
3229	Amia	Amia calva.
5131	Exoglossum	Exoglossum maxillingua.
5421	Percopsis	Percopsis guttatus.
5939	Corvina oscula	Aplodinotus grunniens.
7088	Perca flavescens	Perca flavescens.
7759	Ambloplites rupestris	Ambloplites rupestris.
8236	Semotilus corporalis	Semotilus corporalis.
8461	....do	Do.
8499	Luxilus cornutus	Notropis cornutus.
8961	Photogenis spilopterus	Notropis whipplii.
9087	Micropterus dolomieu	Micropterus dolomieu.
9202	Catostomus teres	Catostomus commersonii.
9238	Semotilus corporalis	Semotilus corporalis.

1853. THOMPSON, ZADOCK.—History of Vermont, natural, civil, and statistical, in three parts, with an appendix. Part I, Natural History, pp. 1 to 224; Appendix, Natural History, pp. 5 to 58, 1853.

Besides the list given in the edition of 1842 Mr. Thompson appends in the present volume an additional list of eight species.

Page.	Nominal species.	Identification.
30	Lucio-Perca canadensis	Stizostedion canadense.
31	Boleosoma tassellatum	Cottogaster copelandi.
31	Cottus gobioides	Uranidea gracilis.
32	Leuciscus atromaculatus	Semotilus atromaculatus.
32	Esox nobilior *	Esox masquinongy.
33	Salmoperca pellucida	Percopsis guttatus.
34	Coregonus clupeiformis	Argyrosomus artedi.
35	Amia ocellicauda	Amia calva.

* Although the name *Esox nobilior* was first used by Thompson in 1849 (see *ante*), the first description of the supposed new species appeared in this place.

1872. DUMÉRIL, AUGUST.—Histoire Naturelle des Poissons, II, 1870, 1–608.

Page.	Nominal species.	Identification.
135	Acipenser (Huso) megalaspis *	Acipenser rubicundus.
419	Amia thompsonii *	Amia calva.

1855. AGASSIZ, L.—Synopsis of the ichthyological fauna of the Pacific slope of North America, chiefly from the collection made by the United States expedition under the command of Capt. C. Wilkes, with recent additions and comparisons with eastern types. <American Journal of Sciences and Arts, 1855, 71–99.

Page.	Nominal species.	Identification.
76	Carpiodes thompsoni *	Carpiodes thompsoni.

1877. HALLOCK, CHARLES.—Game Fish of North America. The Sportsman's Gazetteer and General Guide. The game animals, birds, and fishes of North America: Their habits and various methods of capture. Copious instructions in shooting, fishing, taxidermy, woodcraft, etc., together with a directory of the principal game resorts of the country; illustrated with maps, 1877, 239–407 (1–688 and 1–208).

Page.	Nominal species.	Identification.
273	Centrarchus æneus	Ambloplites rupestris.
292	Esox reticulatus	Esox reticulatus.
304	Salmo confinis	Cristivomer namaycush.
305	Salmo adirondakus	
308	Coregonus labradoricus	Coregonus labradoricus.
310	Osmerus mordax	Osmerus mordax.

1883. JORDAN, DAVID S., and GILBERT, CHARLES H.—Synopsis of the Fishes of North America, Bull. 16, U. S. Nat. Mus. LVI + 1018, 1883.

On page 498, specimen No. 1314, U. S. Nat. Mus., collected in Westport Brook, Essex County, New York, is described as *Cottogaster putnami*, which proves to be a synonym of *C. copelandi*.

1894. EVERMANN, B. W., AND BEAN, B. A.—A collection made in Lake Champlain and tributary waters by the senior author and Mr. B. A. Bean in 1894, is referred to in this paper as "Evermann & Bean coll. 1894." It consists of twenty-one species, which is about 40 per cent of all the species recorded from Lake Champlain and tributaries.

1. Lepisosteus osseus.
2. Catostomus commersonii.
3. Pimephales notatus.
4. Semotilus corporalis.
5. Abramis crysoleucas.
6. Notropis blennius.
7. Notropis hudsonius.
8. Notropis whipplii.
9. Notropis cornutus.
10. Notropis atherinoides.
11. Notropis rubrifrons.
12. Rhinichthys cataractæ.
13. Rhinichthys atronasus.
14. Exoglossum maxillingua.
15. Eucalia inconstans.
16. Esox reticulatus.
17. Ambloplites rupestris.
18. Micropterus dolomieu.
19. Perca flavescens.
20. Percina caprodes.
21. Boleosoma nigrum olmstedi.

1894. EVERMANN, B. W., and KENDALL, W. C.—An annotated list of the fishes known from the State of Vermont. <Report of U. S. Fish Commission 1894 (1896), 579–604.

Page.	Nominal species.	Identification.
584	Acipenser rubicundus	Acipenser rubicundus.
584	Lepisosteus osseus	Lepisosteus osseus.
585	Ameiurus lacustris	Ameiurus lacustris.
585	Ameiurus nebulosus	Ameiurus nebulosus.
586	Carpiodes thompsoni	Carpiodes thompsoni.
586	Catostomus commersonii	Catostomus commersonii.
586	Moxostoma aureolum	Moxostoma aureolum.
587	Pimephales notatus	Pimephales notatus.
587	Semotilus corporalis	Semotilus corporalis.
587	Notropis hudsonius	Notropis hudsonius.
588	Exoglossum maxillingua	Exoglossum maxillingua.
589	Coregonus clupeiformis	Coregonus clupeiformis.
590	Coregonus labradoricus	Coregonus labradoricus.
591	Argyrosomus artedi	Argyrosomus artedi.
593	Osmerus mordax	Osmerus mordax.
597	Lucius reticulatus	Esox reticulatus.
597	Lucius lucius	Esox lucius.
598	Lucius masquinongy	Esox masquinongy.
599	Eucalia inconstans	Eucalia inconstans.
600	Ambloplites rupestris	Ambloplites rupestris.
600	Eupomotis gibbosus	Eupomotis gibbosus.
600	Micropterus dolomieu	Micropterus dolomieu.
601	Stizostedion vitreum	Stizostedion vitreum.
601	Stizostedion canadense	Stizostedion canadense.
602	Perca flavescens	Perca flavescens.
602	Percina caprodes	Percina caprodes.
603	Boleosoma nigrum olmstedi	Boleosoma nigrum olmstedi.
603	Aplodinotus grunniens	Aplodinotus grunniens.
603	Lota maculosa	Lota maculosa.

1897. RATHBUN, RICHARD, and WAKEHAM, WILLIAM.—Report of the Joint Commission relative to the preservation of the fisheries in waters contiguous to Canada and the United States. House Document No. 315, Fifty-fourth Congress, second session, 1897, 14–178.

Page.	Nominal species.	Identification.
42	Stizostedion vitreum	Stizostedion vitreum.
43	Coregonus labradoricus	Coregonus labradoricus.
43	Coregonus clupeiformis	Coregonus clupeiformis.
44	Black bass	Micropterus dolomieu.
44	Lake trout	Cristivomer namaycush.
45	Yellow perch	Perca flavescens.

1897. MONTPETIT, A. N.—Les poissons d'eau douce du Canada, 1897, XIV+1–583.

Page.	Nominal species.	Identification.
445	Le namaycush	Cristivomer namaycush.

1898. TITCOMB, JOHN W.—On November 10, 1898, Mr. John W. Titcomb made a considerable collection of fishes in Caspian Lake. These were sent to the Fish Commission for identification, and represent the following species: *Catostomus catostomus, Catostomus commersonii, Semotilus atromaculatus, Notropis cornutus, Couesius plumbeus, Salmo sebago, Cristivomer namaycush, Salvelinus fontinalis,* and *Osmerus mordax.* Of these the Sebago salmon, lake trout, and the smelt were introduced.

LIST OF SPECIES.

1. **Ichthyomyzon concolor** (Kirtland). *Silver Lamprey; "Mud-eel"; "Blind-eel."* Lake Champlain (De Kay 1842) and Winooski River (Thompson 1842). Not seen by us, but common according to Thompson.
2. **Acipenser rubicundus** Le Sueur. *Lake Sturgeon.* Lake Champlain (Thompson 1842, Duméril 1870, and Evermann & Kendall 1894). Not uncommon. Mr. J. W. Titcomb informs us that examples weighing as much as 75 pounds are often taken.
3. **Lepisosteus osseus** (Linnæus). *Gar-pike.* Lake Champlain and Winooski River at Burlington (Thompson 1842); Lake Champlain (Evermann & Kendall 1894), and Lake Champlain at Rouses Point (Evermann & Bean coll. 1894). Common.
4. **Amia calva** Linnæus. *"Bowfin"; "Mud-fish"; "Scaled Ling."* Lake Champlain at Westport, N. Y. (Baird coll. 1850); Lake Champlain at Whitehall, and Winooski River (Thompson 1853); and Lake Champlain (Duméril 1872). Common; reaching a weight of several pounds.
5. **Ameiurus lacustris** (Walbaum). *Great Lakes Cat-fish; "Cat-fish."* Lake Champlain and Winooski River (Thompson 1842); Missisquoi Bay (Evermann & Kendall 1894). A female received April 25, from Missisquoi Bay, was 25 inches long and weighed 7.25 pounds.
6. **Ameiurus vulgaris** (Thompson). *"Bullpout."* Lake Champlain (Thompson 1842). Said by Thompson to be plentiful.
7. **Ameiurus nebulosus** (Le Sueur). *"Hornpout."* Lake Champlain at Westport, N. Y. (Baird coll. 1850); Lake Champlain (Evermann & Kendall 1894); and Upper Saranac Lake (Evermann coll. 1901). Doubtless abundant.
8. **Carpiodes thompsoni** Agassiz. *"Carp Sucker"; "Drum"; "Buffalo."* Lake Champlain (Agassiz 1855, and Evermann & Kendall 1894). A nearly ripe female 21 inches long and weighing 7 pounds was received April 25. The ovaries alone weighed 2.5 pounds.
9. **Catostomus catostomus** (Forster). *Long-nosed Sucker.* State of Vermont (Le Sueur 1817), Caspian Lake (Titcomb coll. 1898), and Little Clear Pond near Saranac Inn (Evermann coll. 1901). This sucker is abundant in Sleeper River, in the eastern part of Vermont. Though not definitely recorded from Lake Champlain since Le Sueur's time, it is doubtless not rare there. It is common in Little Clear Pond at the Saranac State fish-hatchery.
10. **Catostomus commersonii** (Lacépède). *Common Sucker; "Black Sucker"; "Black-fin Sucker."* Lake Champlain (Thompson 1842, Baird coll. 1850); Missisquoi Bay (Evermann & Kendall 1894); Saranac River, Plattsburg, N. Y. (Evermann & Bean coll. 1894); Caspian Lake (Titcomb coll. 1898); and Little Clear Pond near Saranac Inn (Evermann coll. 1901). Doubtless common. A nearly ripe female weighing 3 pounds was received April 25 from Missisquoi Bay. The species apparently spawns here early in May.
11. **Moxostoma aureolum** (Le Sueur). *Redhorse; "Mullet."* Lake Champlain (Thompson 1842), and Missisquoi Bay (Evermann & Kendall 1894). A nearly ripe male 15 inches long, weighing 1.5 pounds, and a nearly ripe female 25.5 inches long, weighing 7.25 pounds, were received April 25 from Missisquoi Bay.

12. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* Missisquoi Bay (Evermann & Kendall 1894); Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894). Common throughout the lake.
13. **Semotilus corporalis** (Mitchill). *Silver Chub.* Lake Champlain (Thompson 1842, DeKay 1842, and Evermann & Kendall 1894); Lake Champlain, Westport, N. Y. (Baird coll. 1850); and Scioto Creek, Coopersville, N. Y., and Saranac River, Plattsburg, N.Y. (Evermann & Bean coll. 1894). Common.
14. **Semotilus atromaculatus** (Mitchill). *Horned Dace; Creek Chub.* Thompson (1853) says: "This is one of the most common fishes of this genus in the western part of Vermont. It abounds almost everywhere, both in the rivers and small streams." Caspian Lake (Titcomb coll. 1898).
15. **Abramis crysoleucas** (Mitchill). *Roach.* Lake George (Rafinesque 1817 and 1820); Lake Champlain (Thompson 1842); Rouses Point and Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894). Probably common.
16. **Notropis blennius** (Girard). *Straw-colored Minnow.* Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894). Several specimens (12) were obtained of a species of *Notropis* which we provisionally identified with this species, but they were unfortunately lost before the identification could be verified. They were each 2 to 2.75 inches long, and one example examined gave the following characters: Head 4; depth 5; eye large, 3; scales 6–36–3, 13 rows before dorsal; teeth 4–4; D. 8; A. 7.
17. **Notropis hudsonius** (Clinton). *Spot-tail Minnow.* Missisquoi Bay (Evermann & Kendall 1894); Scioto Creek, Coopersville, N. Y., and Rouses Point, N. Y. (Evermann & Bean coll. 1894). Doubtless common in the lake.
18. **Notropis whipplii** (Girard). *Silver-fin.* Lake Champlain at Westport, N. Y. (Baird coll. 1850); Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894). Apparently not common.
19. **Notropis cornutus** (Mitchill). *Red-fin.* Lake Champlain at Westport, N. Y. (Baird coll. 1850); Saranac River, Plattsburg, N. Y., and Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894); and Caspian Lake, (Titcomb coll. 1898). One of the most abundant creek minnows.
20. **Notropis atherinoides** Rafinesque. *Silverside Minnow.* Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894). Not common; only one specimen obtained.
21. **Notropis rubifrons** (Cope). *Rosy-front Minnow.* Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894). Probably common in the streams.
22. **Rhinichthys cataractæ** (Cuvier & Valenciennes). *Long-nosed Dace.* Saranac River, Plattsburg, N. Y. (Evermann & Bean coll. 1894). Common; 50 specimens obtained, each 2 to 3.5 inches long.
23. **Rhinichthys atronasus** (Mitchill). *Black-nosed Dace.* Lake Champlain tributaries (Thompson 1842); Saranac River, Plattsburg, N. Y. (Evermann & Bean coll. 1894). Apparently less common than the preceding species; only 8 examples obtained.
24. **Couesius plumbeus** (Agassiz). Caspian Lake (Titcomb coll. 1898).
25. **Exoglossum maxillingua** (Le Sueur). *Cutlip.* Lake Champlain (Rafinesque 1818); Saranac Lake (Baird coll. 1850); Plattsburg, N. Y. (Evermann & Kendall 1894); Scioto Creek, Coopersville, N. Y., and Saranac River, Plattsburg, N. Y. (Evermann & Bean coll. 1894). Probably not abundant; only one specimen obtained in Scioto Creek and 7 in the Saranac River.
26. **Anguilla chrysypa** Rafinesque. *Common Eel.* Lake George, Lake Champlain, etc. (Rafinesque 1817).
27. **Hiodon tergisus** Le Sueur. *Moon-eye; "White Shad."* Lake Champlain (Thompson 1842). Not common.
28. **Coregonus quadrilateralis** Richardson. *Round White-fish; "Frost-fish"; Menominee White-fish.* Lake Champlain (Evermann & Kendall 1894).

29. **Coregonus clupeiformis** (Mitchill). *Common White-fish.* Lake Champlain (Thompson 1842, Rathbun & Wakeham 1897, and Evermann & Kendall 1894).

30. **Coregonus labradoricus** (Richardson). *"Shad-waiter"; "Shad."* Lake Champlain (Hallock 1877); Missisquoi Bay (Evermann & Kendall 1894 and Rathbun & Wakeham 1897); Butler Island and Maquam (Rathbun & Wakeham 1897). This is the most abundant species of white-fish occurring in this lake.

31. **Argyrosomus artedi** (Le Sueur). *Cisco.* Lake Champlain (Thompson 1853). There are specimens in the U. S. National Museum from Lake Champlain as follows: No. 17000 from Vergennes; Nos. 35348, 35350, and 7307 from Lake Champlain; No. 35351, Ticonderoga.

32. **Salmo salar** Linnæus. *Salmon.* Lake Champlain (Thompson 1842). Formerly very plentiful in the lake, but we have seen no recent references.

[**Salmo sebago** Girard. Introduced into Caspian Lake (Titcomb coll. 1898)].

33. **Salvelinus fontinalis** (Mitchill). *Brook Trout.* Caspian Lake (Titcomb coll. 1898) and Upper Saranac Lake (Evermann coll. 1901). Doubtless common in most of the Adirondack waters tributary to the lake.

34. **Cristivomer namaycush** (Walbaum). *Lake Trout*; *"Longe."* Lake George (Rafinesque 1817); Lake Champlain (Rafinesque 1817, Thompson 1842, Rathbun & Wakeham 1897, and Montpetit 1897); Lower Saranac Lake (Hallock 1877); Caspian Lake (Titcomb coll. 1898). Formerly not rare, but now not often taken.

35. **Osmerus mordax** (Mitchill). *Smelt; "Ice-fish."* Lake Champlain (Thompson 1842, Hallock 1877, and Evermann & Kendall 1894); Caspian Lake (Titcomb coll. 1898). Common; caught through ice in February and March.

36. **Umbra limi** (Kirtland). *Mud Minnow.* Lake Champlain (Thompson 1842). Apparently rare.

37. **Esox reticulatus** Le Sueur. *Pickerel.* Lake Champlain (Hallock 1877); Missisquoi Bay (Evermann & Kendall 1894). Rather common.

38. **Esox lucius** Linnæus. *Pike.* Lake Champlain (Thompson 1842 and Evermann & Kendall 1894). Common.

39. **Esox masquinongy** Mitchill. *Muskallunge.* River Lamoille (Thompson 1849 and 1853); Lake Champlain (Evermann & Kendall 1894). Taken only occasionally.

40. **Eucalia inconstans** (Kirtland). *Brook Stickleback.* Tributary brook of Pike River, which flows into Missisquoi Bay (Evermann & Kendall 1894); Saranac River, Plattsburg, N. Y. (Evermann & Bean coll. 1894). Common locally.

41. **Percopsis guttatus** Agassiz. *Trout Perch.* Lake Champlain at Burlington and Winooski River (Thompson 1849 and 1853); Lake Champlain at Westport, N. Y. (Baird coll. 1850). Not common.

42. **Ambloplites rupestris** (Rafinesque). *Rock Bass.* Lake Champlain (Thompson 1842 and Hallock 1877); Lake George (Baird coll. 1850); Missisquoi Bay (Evermann & Kendall 1894); Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894). Quite common.

43. **Eupomotis gibbosus** (Linnæus). *Common Sun-fish; "Pond Perch."* Lake Champlain (Thompson 1842.) Common.

44. **Micropterus dolomieu** Lacépède. *Small-mouth Black Bass.* Lake Champlain (Baird coll. 1850); Missisquoi Bay (Evermann & Kendall 1894); Lake Champlain (Rathbun & Wakeham 1897); Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894.) Common.

45. **Micropterus salmoides** (Lacépède). *Large-mouth Black Bass.* No specimens obtained by us, but Mr. John W. Titcomb informs us that it is quite common in Lake Champlain and in several ponds in Vermont.

46. **Stizostedion vitreum** (Mitchill). *Wall-eyed Pike.* Lake Champlain (Thompson 1842); Lake Champlain, Winooski and Lamoille rivers (Evermann & Kendall 1894); Missisquoi Bay, Hog Island, and Alburg shore (Rathbun & Wakeham 1897). A common and important food fish. An unripe male 25 inches long, weighing 5.5 pounds, and an unripe female 18.25 inches long, weighing 2.5 pounds, were received April 25 from Missisquoi Bay. Their condition indicated that their spawning time would be some time in May.

47. **Stizostedion canadense** (Smith). *Sauger; "Rock Pike."* Lake Champlain (Thompson 1842 and Evermann & Kendall 1894). Probably not very common. A nearly ripe female, 14.5 inches long and weighing three-fourths of a pound, and an unripe male 15 inches long, of the same weight, were received April 25. These indicated a spawning time for the species a little earlier than for the wall-eyed pike.

48. **Perca flavescens** (Mitchill). *Yellow Perch.* Lake Champlain basin (Thompson 1842; Baird coll. 1850); Missisquoi Bay (Evermann & Kendall 1894); Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894); Lake Champlain (Rathbun & Wakeham 1897); Upper Saranac Lake at Rustic Lodge (Evermann coll. 1900 and 1901). Very abundant everywhere.

49. **Percina caprodes** (Rafinesque). *Log Perch.* Lake Champlain basin (Thompson 1842); Missisquoi Bay and Lake Champlain at Rouses Point and Plattsburg (Evermann & Kendall 1894); and Scioto Creek, Coopersville, N. Y. (Evermann & Bean coll. 1894). Apparently not common.

50. **Cottogaster copelandi** (Jordan). *Copeland's Darter.* Lake Champlain? (Thompson 1853); Westport Brook, Essex County, N. Y. (Jordan & Gilbert 1883).

51. **Boleosoma nigrum olmstedi** (Storer). *Tesselated Darter.* Missisquoi Bay (Evermann & Kendall 1894); Scioto Creek, Coopersville, N. Y., and Saranac River, Plattsburg, N. Y. (Evermann & Bean coll. 1894). Quite common in all suitable places.

52. **Aplodinotus grunniens** (Rafinesque). *Fresh-water Drum; "Sheepshead."* Lake Champlain (Thompson 1842 and Baird coll. 1850); and Missisquoi Bay (Evermann & Kendall 1894). Said to be quite common. An unripe male 28 inches long, weighing 12.5 pounds, and a nearly ripe male 19 inches long, weighing 3.75 pounds, were received from Missisquoi Bay April 25.

53. **Lota maculosa** (Le Sueur). *Ling; "Methy."* Lake Champlain basin (Thompson 1842); Missisquoi Bay (Evermann & Kendall 1894). Probably common.

54. **Uranidea gracilis** (Heckel). *"Chucklehead."* River Lamoille, Johnson, Vt. (Thompson 1853). Apparently not common.

AN ANNOTATED LIST OF THE FISHES KNOWN TO OCCUR IN THE ST. LAWRENCE RIVER.

By Barton Warren Evermann and William Converse Kendall.

In June and July, 1894, the senior writer of this paper and Mr. Barton A. Bean, of the United States National Museum, made a considerable collection of fishes in the St. Lawrence River and certain of its tributaries in New York and Vermont. The principal stations where collecting was done were in the St. Lawrence River below Cape Vincent, near Clayton, near Alexander Bay, and below Ogdensburg; in the Racket River at Norfolk, and in Lake Memphremagog and Clyde River, Vermont. The collecting at Cape Vincent was done along the river shore on the New York side just above the town, and at Grass Bay, 4 miles below the town. The species seen at Clayton and Alexander Bay were either in the markets or live-boxes. The collecting at Ogdensburg was done on the Canadian shore of the St. Lawrence River, about 4 or 5 miles below the town, and around Spencer and Chimney islands, 24 species being obtained. The Racket River was examined one mile below Norfolk. Seining was done on a riffle with bed-rock bottom covered more or less by loose stones. Lake Memphremagog and Clyde River were seined near Newport, and we have already reported upon the collection in "Fishes of Vermont."

While at Axton, in the college forest of the New York State College of Forestry in the spring of 1900 and 1901, Professor Evermann obtained a few fishes from Follingsby, Rock, and Ampersand ponds, all of which are tributary to the Racket River.

Through the kindness of the late Hon. A. Nelson Cheney, of the New York State Fish Commission, the United States Fish Commission received in December, 1900, 8 specimens of the Labrador white-fish from Chateaugay Lake.

The present paper is a report upon these various collections; and that the paper may correctly and fully represent our present knowledge of the fish-fauna of the St. Lawrence River, we have included all previously published references, known to us, to fishes in that river or its tributary waters. For obvious reasons we have not included references to the Great Lakes nor to Lake Champlain. The exact

territory included may be stated as the St. Lawrence River proper from the outlet of Lake Ontario to its mouth in the Gulf of St. Lawrence, together with all its tributary streams and lakes between those two points, exclusive of Lake Champlain, upon whose fishes we have prepared a separate report.

That the paper may be more useful as a guide to the literature pertaining directly to the fishes of the St. Lawrence River basin, a bibliography of all papers of that character known to us is given. The titles are arranged chronologically, and under each is given a list of the species mentioned in it, and our identification of each in current nomenclature. In the formal list of species reference is made back to the authority for the record.

The total number of species now known from the St. Lawrence basin, as herein limited, is 71, only 63 of which are fresh-water species, a number surprisingly few and to be accounted for chiefly by the fact that so little collecting has really been done in the St. Lawrence or its tributaries. Very little has been done in the river itself or in any of its southern tributaries, while the vast territory lying north and west of the St. Lawrence and drained by it is, ichthyologically, almost a *terra incognita* so far as definite knowledge of its fishes is concerned. It has long been known to anglers as the fisherman's paradise, but the anglers are uncertain even as to the species of trout found therein, to say nothing of the species which are not game fishes. Explorations in this region are necessary to make out the geographic distribution of several species now little understood, notably the Canadian red trout, the ouananiche, and the other *Salmonidæ*. Even the relationships of a number of the *Salmonidæ* remain to be determined. Systematic collecting anywhere north of the St. Lawrence would add very materially to our knowledge of the relationships and distribution of the fishes of that vast territory; and careful collecting in the streams and lakes of northern New York would doubtless add many species to the fishes now known from that region. Localities of special interest are Chateaugay and Chazy lakes, the Racket River basin, and the Oswegatchie River. The lower St. Lawrence tributaries also deserve careful investigation.

BIBLIOGRAPHY.

1836. Richardson, John. Fauna Boreali-Americana, or the Zoology of the northern part of British America. Part Third. The Fish, 1836, i–xv+1–327.

Nominal species.	Identification.
Labrax notatus*	Roccus lineatus.
Cyprinus (Abramis) Smithii*	Hiodon tergisus.
Salmo salar	Salmo salar.
Anguilla rostrata	Anguilla chrysypa.

*The species described as new in each paper are indicated by an asterisk.

1853. Baird, Spencer F. A small collection of fishes made by Professor Baird in September, 1853, in the neighborhood of Montreal and Quebec, and recorded in the catalogues of the department of fishes, United States National Museum, is referred to in this paper as "Baird coll. 1853." No report on this collection has ever been published.

Cat. No.	Nominal species.	Identification.
1256, 1260	Boleosoma olmstedi	Boleosoma nigrum olmstedi.
1257	Percina caprodes	Percina caprodes.
1258	Catonotus fiabellatus	Etheostoma fiabellare.
5442	Perca flavescens	Perca flavescens.
8965	Semotilus corporalis	Semotilus corporalis.
9191	Hyborhynchus	Pimephales notatus.

1859. Dawson, J. W. On a new species of stickleback (*Gasterosteus gymnetes*). <Canadian Naturalist and Geologist, iv, 1859, 321–324, 3 figures.

Nominal species.	Identification.
Gasterosteus gymnetes*	Eucalia inconstans.

1859. Herbert, William Henry. Frank Forester's Fish and Fishing of the United States and British Provinces of North America, 1859, i-xv + 16–512.

Nominal species.	Identification.
Huro nigricans; Centrarchus fasciatus; Gristes nigricans	Micropterus dolomieu.
Salmo salar	Salmo salar.
Salmo fontinalis	Salvelinus fontinalis.

1862. Fortin, Pierre. List of the cetacea, fishes, crustacea, and mollusca, which now inhabit and have inhabited the Canadian shores of the Gulf of St. Lawrence and are objects of fishing operations, whether on a large or small scale, and which are used as bait, etc. <Annual Report of Pierre Fortin, esq., magistrate in command of the expedition for the protection of the fisheries in the Gulf of St. Lawrence, during the season of 1862; Appendix 109–124.

Nominal species.	Identification.
Clupea alosa	Alosa sapidissima.
Clupea sardina	Clupea harengus.
Scombrus scombrus	Scomber scombrus.
Hippoglossus vulgaris	Hippoglossus hippoglossus.
Pleuronectes flesus	Pseudopleuronectes americanus.
Muræna anguilla	Anguilla chrysypa.
Salmo fontinalis; Salmo trutta; Salmo albus	Salvelinus fontinalis.
Osmerus viridescens; Osmerus eperlanus	Osmerus mordax.
Salmo salar	Salmo salar.
Cod	Gadus callarias.

1863. FORTIN, PIERRE. Continuation of the list of fish of the Gulf and River St. Lawrence. <Annual Report of Pierre Fortin, esq., commanding the expedition for the protection of the fisheries in the Gulf of St. Lawrence during the season of 1863. Fisheries appendices from Annual Report for 1863, of the Hon. Wm. McDougal, commissioner of crown lands, for the year 1863 (1864), 60–72.

Nominal species.	Identification.
Perca flavescens	Perca flavescens.
Labrax lineatus; Perca saxatilis	Roccus lineatus.
Catostomus communis	Catostomus commersonii.
Alosa tyrannus; Alosa vernalis	Pomolobus pseudoharengus.
Esox reticulatus	Esox reticulatus.
Esox estor	Esox lucius.
Coregonus albus	Coregonus labradoricus.
Lota inornata; Lota vulgaris	Lota maculosa.
Cyclopterus lumpus; Lumpus vulgaris	Cyclopterus lumpus
Acipenser oxyrhinchus	Acipenser sturio.
Petromyzon	Ichthyomyzon concolor.

1864. FORTIN, PIERRE. Continuation of the list of fishes found in the Gulf and River St. Lawrence. <Annual report of Pierre Fortin, esq., stipendiary magistrate, commander of the expedition for the protection of fisheries in the Gulf of St. Lawrence on board *La Canadienne* during the season of 1864 (1865), 61–69.

Nominal species.	Identification.
Lucioperca americana	Stizostedion vitreum.
Lucio-perca canadense	Stizostedion canadense.
Centrarchus æneus	Ambloplites rupestris.
Pomotis vulgaris	Eupomotis gibbosus.
Hiodon tergisus	Hiodon tergisus.
Lepisosteus osseus; Lepisosteus longirostris	Lepisosteus osseus.
Acipenser brevirostris	Acipenser sturio.
"Short-nosed Sturgeon (Le Sueur)"	Acipenser brevirostris.

1865. FORTIN, PIERRE. Continuation of the list of fishes taken in the Gulf and River St. Lawrence. <Annual report of Pierre Fortin, esq., stipendiary magistrate in command of the expedition for the protection of the fisheries in the Gulf of St. Lawrence, on board *La Canadienne* during the season of 1865 (1866), 69–79.

Nominal species.	Identification.
Pimelodus nebulosus	Ameiurus nebulosus.
Leuciscus canadensis*	Semotilus corporalis.
Leuciscus vittatus	Notropis cornutus.
Leuciscus atromaculatus	Semotilus atromaculatus.
Cyprinus catostomus; Catostomus forsterianus	Catostomus catostomus.
Catostomus tuberculatus	Erimyzon sucetta oblongus.
Catostomus macrolepidotus	Moxostoma aureolum?
Sclerognathus cyprinus	Carpiodes thompsoni?
Hydrargyra atricauda	Umbra limi.
Amia ocellicauda	Amia calva.

1868. GÜNTHER, ALBERT. Catalogue of the fishes in the British Museum, VII, I–XX+1–512, 1868.

Nominal species.	Identification.
Catostomus teres	Catostomus commersonii.
Catostomus carpio	Moxostoma aureolum.
Rhinichthys marmoratus	Rhinichthys cataractæ.

1873. WHITEAVES, J. F. Report on further deep-sea dredging operations in the Gulf of St. Lawrence, with notes on the present condition of the marine fisheries and oyster beds of part of that region. <Sixth Annual Report of the Department of Marine and Fisheries. Appendix U, 1873, 178–204.

Nominal species.	Identification.
Osmerus viridescens	Osmerus mordax.

1873. HALLOCK, CHARLES. The Fishing Tourist; Angler's Guide and Reference Book; I–XIV+15–239, 1873.

Nominal species.	Identification.
Salmo gloveri	Salmo ouananiche.
Salmo salar	Salmo salar.

1877. HALLOCK, CHARLES. The Sportsman's Gazetteer and General Guide * * * The Game Fishes of North America, 239–411, 1877.

Nominal species.	Identification.
Esox nobilior; Esox estor	Esox masquinongy.
Esox lucius	Esox lucius.
Salmo salar	Salmo salar.
Salmo sebago	Salmo sebago.
Coregonus labradoricus	Coregonus labradoricus.

1884. ROOSEVELT, ROBERT BARNWELL. The Game Fish of the Northern States and British Provinces, 1–324, 1884.

Nominal species.	Identification.
Salmo trutta marina	Salvelinus fontinalis.
Salmon	Salmo salar.
Trout	Salvelinus fontinalis.
Gristes nigricans	Micropterus dolomieu.

1884. JORDAN, DAVID S. Description of four new species of *Pœcilichthys* in the United States National Museum. <Proc. U. S. Nat. Mus. 1884 (Sept. 27, 1885), 477–480.

Nominal species.	Identification.
Pœcilichthys borealis	Etheostoma boreale.

1884. Goode, George Brown. Natural history of useful aquatic animals. <The fisheries and fishery industry of the United States, section I, text, i–xxxiv + 1–895, 1884.

Nominal species.	Identification.
Roccus lineatus	Roccus lineatus.
Micropterus dolomieu	Micropterus dolomieu.
Micropterus salmoides	Micropterus salmoides.
Clupea vernalis	Pomolobus pseudoharengus.
Clupea sapidissima	Alosa sapidissima.
Salmo salar	Salmo salar.
Esox nobilior	Esox masquinongy.

1886. Mather, Fred. Memoranda relating to Adirondack fishes, with descriptions of new species, from researches made in 1882. Adirondack Survey, appendix, twelfth report (zoology), 1886, 1–56.

Nominal species.	Identification.
Micropterus dolomieu	Micropterus dolomieu.
Esox lucius	Esox lucius.
Eels	Anguilla chrysypa.
Semotilus bullaris	Semotilus corporalis.
Prosopium quadrilaterale	Coregonus quadrilateralis.
Ameiurus catus	Ameiurus nebulosus.
Uranidea gracilis	Uranidea gracilis.

1892. Roberts, Charles D. The Canadian Guide Book, i–viii + 1–270, 1892.

Nominal species.	Identification.
Ouananiche	Salmo ouananiche.
Salmon	Salmo salar.

1892. Creighton, J. G. Aylwin. The landlocked salmon, or Wananishe. <American Game Fishes. Their habits, habitat, and peculiarities; how, when, and where to angle for them. 81–110, 1892.

Nominal species.	Identification.
Salmo salar, variety Sebago	Salmo ouananiche.
Esox lucius	Esox lucius.
Stizostedium vitreum	Stizostedion vitreum.
Trout	Salvelinus fontinalis.

1893. Garman, S. The Lac de Marbre trout, a new species. <Science, July 14, 1893, 23.

Nominal species.	Identification.
Salmo (Salvelinus) Marstoni	Salvelinus marstoni.

1894. Evermann, Barton W., and Smith, Hugh M. The Whitefishes of North America. <Report U. S. Fish Commission for 1894 (1896), 283–324, and pls. 11–27.

Nominal species.	Identification.
Coregonus labradoricus	Coregonus labradoricus.

1894. McCarthy, Eugene. The Leaping Ouananiche; what it is; where, when, and how to catch it. 1894, 1–66. Forest and Stream Publishing Co.

Nominal species.	Identification.
Ouananiche	Salmo ouananiche.
S. fontinalis	Salvelinus fontinalis.
Pickerel (Brochet)	Esox lucius.
Pike (Doré)	Stizostedion vitreum.

1894. Evermann, B. W., and Bean, B. A. A collection made at various points in the St. Lawrence River, in New York and vicinity, by the senior author and Mr. B. A. Bean in 1894, is referred to in this paper as "Evermann & Bean coll. 1894." It consists of 31 species, 10 of which have not to our knowledge been previously recorded from the St. Lawrence basin.

1. Ichthyomyzon concolor.
2. Acipenser rubicundus.
3. Ameiurus lacustris.
4. Catostomus commersonii.
5. Moxostoma anisurum.*
6. Pimephales notatus.
7. Semotilus corporalis.
8. Notropis blennius.*
9. Notropis hudsonius.*
10. Notropis whipplii.*
11. Notropis atherinoides.*
12. Notropis rubrifrons.*
13. Rhinichthys atronasus.
14. Couesius plumbeus.
15. Exoglossum maxillingua.*
16. Pomolobus pseudoharengus.
17. Esox lucius.
18. Esox masquinongy.
19. Fundulus diaphanus.*
20. Percopsis guttatus.*
21. Ambloplites rupestris.
22. Eupomotis gibbosus.
23. Micropterus dolomieu.
24. Micropterus salmoides.
25. Stizostedion vitreum.
26. Perca flavescens.
27. Percina caprodes.
28. Cottogaster cheneyi.
29. Boleosoma nigrum olmstedi.
30. Cottus ictalops.*
31. Lota maculosa.

1894. Evermann, Barton W., and Kendall, William C. An annotated catalogue of the fishes known from the State of Vermont. <Report U. S. Fish Commission for 1894 (1896), 579–604.

The following species are recorded in this paper from the St. Lawrence basin:

1. Ameiurus nebulosus.
2. Catostomus commersonii.
3. Semotilus corporalis.
4. Semotilus atromaculatus.
5. Notropis cornutus.
6. Rhinichthys atronasus.
7. Couesius plumbeus.
8. Coregonus quadrilateralis.
9. Coregonus labradoricus.
10. Cristivomer namaycush.
11. Osmerus mordax.
12. Esox lucius.
13. Micropterus dolomieu.
14. Perca flavescens.

1896. Chambers, E. T. D. The Ouananiche and its Canadian environment. I–XXII + 1–357, 1896.

Nominal species.	Identification.
Ouananiche	Salmo ouananiche.
Salvelinus namaycush	Cristivomer namaycush.
Salmo salvelinus marstonii	Salvelinus marstoni.
Ouitouche or chub	Semotilus corporalis.
Coregonus clupeiformis	Coregonus labradoricus.
Pickerel or Doré	Stizostedion vitreum.
Esox lucius	Esox lucius.
Lota americana; Lota maculosa	Lota maculosa.

1897. MONTPETIT, A. N. Les poissons d'eau douce du Canada, 1–552, 1897.

Nominal species.	Identification.
Perca flavescens	Perca flavescens.
Lucioperca americana; Stizostedion vitreum	Stizostedion vitreum.
S. Canadense	Stizostedion canadense.
Esox Estor; Esox Lucius	Esox lucius.
Esox nobilior	Esox masquinongy and Esox lucius, in part.
Pomoxys sparoides; Labrus sparoides	Pomoxis sparoides.
Ambloplites	Ambloplites rupestris.
Lepomis gibbosus	Eupomotis gibbosus.
Micropterus dolomieu	Micropterus dolomieu.
Micropterus salmoides	Micropterus salmoides.
Labrax lupus; Labrax lineatus; Sciena lineata; Centropome raye; Roccus striatus	Roccus lineatus.
Aspro vulgaris; Alvordius aspro	Etheostoma boreale.?
Le Chabot	Uranidea gracilis, in part.?
Microgadus morrhua	Microgadus tomcod.?
Gadus lota	Lota maculosa.
Acipenser sturio	Acipenser sturio; Acipenser rubicundus.
Acipenser brevirostris	Acipenser brevirostris.
Lepisosteus osseus	Lepisosteus osseus.
Le Poisson-castor	Amia calva.
Clupea sapidissima	Alosa sapidissima.
Le Gasparot	Pomolobus pseudoharengus.
Hiodon tergisus	Hiodon tergisus.
Ictalurus nigricans	Ameiurus lacustris.
Ameiurus	Ameiurus nebulosus.
Anguilla vulgaris; Anguilla Murena	Anguilla chrysypa.
Salmo salar	Salmo salar.
Salmo fontinalis	Salvelinus fontinalis.
Trutta argentea	Salvelinus fontinalis.
Otsego Bass	Coregonus clupeiformis.
La Truite des Lacs; Touladi	Cristivomer namaycush.
Osmerus viridescens	Osmerus mordax.
Le Huananiche	Salmo ouananiche.
Moxostoma aureolus	Moxostoma aureolum.
Catostoma-Bostoniensis	Catostomus commersonii.
Cyprinus or Abramus Brama	Hiodon tergisus.
Abramis Abramo rutilus	Abramis crysoleucas or Notropis cornutus.
Semotilus bullaris	Semotilus corporalis.

1897. EVERMANN, BARTON W., AND KENDALL, WILLIAM C. Descriptions of new or little-known genera and species of fishes from the United States. <Bull. U. S. Fish Comm. for 1897 (February 9, 1898), 125–133, plates 6–9.

Nominal species.	Identification.
Cottogaster cheneyi*	Cottogaster cheneyi.

1897. RATHBUN, RICHARD, AND WAKEHAM, WILLIAM. Report of the joint commission relative to the preservation of the fisheries in waters contiguous to Canada and the United States. <House Doc. No. 315, Fifty-fourth Congress, second session, 1897, 14–178.

Nominal species.	Identification,
Micropterus dolomieu	Micropterus dolomieu.
Cristivomer namaycush	Cristivomer namaycush.
Perca flavescens	Perca flavescens.
Coregonus labradoricus	Coregonus labradoricus.
Pike	Esox lucius.
Bullheads	Ameiurus nebulosus.
Suckers	Catostomus commersonii.
Smelt	Osmerus mordax.
Ling	Lota maculosa.
Eels	Anguilla chrysypa.
Wall-eyed pike	Stizostedion vitreum.
Sturgeon	Acipenser rubicundus.?
Maskinonge	Esox masquinongy.
Grass pike	Esox reticulatus.
Channel cat	Ameiurus lacustris.?
Sunfish	Eupomotis gibbosus.

1900–1901. EVERMANN, B. W. Small collections made in New York, near Axton, by Professor Evermann in 1900 and 1901 represent eight species, one of which *C. erythrogaster* is apparently recorded from the St. Lawrence Basin for the first time, are referred to in this paper as "Evermann coll. 1900–1901."

1. Ameiurus nebulosus.
2. Chrosomus erythrogaster.
3. Micropterus dolomieu.
4. Micropterus salmoides.
5. Esox lucius.
6. Notropis cornutus.
7. Cristivomer namaycush
8. Salvelinus fontinalis.

LIST OF SPECIES.

1. **Ichthyomyzon concolor** (Kirtland). *Silvery Lamprey.* St. Lawrence River below Quebec (Fortin 1863) and at Cape Vincent (Evermann & Bean coll. 1894).
2. **Acipenser sturio** Linnæus. *Common Sturgeon; "Le Maille."* St. Lawrence River and tributaries (Fortin 1863 and 1864) and River St. Lawrence (Montpetit 1897).
3. **Acipenser rubicundus** Le Sueur. *Lake Sturgeon; "Le Maille."* River St. Lawrence between New York and Ontario (Rathbun & Wakeham 1897); the Ottawa River and Lake Temiscamingue, basin of River St. Lawrence between its mouth and Quebec (Montpetit 1897); the St. Lawrence River below Ogdensburg (Evermann & Bean coll. 1894). At this place 6 sturgeons were seen, each weighing about 15 pounds. They were caught on set lines, pieces of perch and small suckers being used as bait. The lines were set on mud or clay bottom in 60 to 80 feet of water and about 75 hooks were used to each line.
4. **Acipenser brevirostris** Le Sueur. *Short-nosed Sturgeon; "Camus."* River St. Lawrence and streams flowing into it (Fortin 1864); St. Lawrence River, and lacs St. Pierre, St. Louis, and St. Froid (Montpetit 1897).
5. **Lepisosteus osseus** (Linnæus). *Gar Pike; "Poisson Armé."* Lake St. Peter near Sorel, and River St. Lawrence below Quebec (Fortin 1864); basin of the River St. Lawrence (Montpetit 1897).
6. **Amia calva** Linnæus. *Mud-fish; "Le Poisson-castor."* Near Sorel in St. Lawrence River (Fortin 1865); Lake St. Peter (Montpetit 1897).
7. **Ameiurus lacustris** (Walbaum). *Channel Cat; "Barbue."* St. Lawrence River between New York and Ontario (Rathbun & Wakeham 1897); basin of River St. Lawrence, sources of the St. Leon, and the Ottawa (Montpetit 1897); St. Lawrence River at Chippewa Bay (Evermann & Bean coll. 1894).
8. **Ameiurus nebulosus** (Le Sueur). *Horn pout; "Le Barbotte."* River St. Lawrence (Fortin 1865); most waters of St. Lawrence County and Piseco Lake (Mather 1886); St. Lawrence River near Cape Vincent and below Ogdensburg, and Racket River at Norfolk (Evermann & Bean coll. 1894); Clyde River and Lake Memphremagog, Vt. (Evermann & Kendall 1894); River St. Lawrence between New York and Ontario, and Lake Memphremagog (Rathbun & Wakeham 1897); and basins of the Ottawa and St. Lawrence (Montpetit 1897). Specimens obtained near Cape Vincent June 28 were ripe with spawn. The species was quite common there, as it is also in the Racket River and in Follingsby Pond near Axton (Evermann coll. 1900).
9. **Carpiodes thompsoni** Agassiz. *Lake Carp Sucker.* Near Lapraire, River St. Lawrence, and some of its tributaries (Fortin 1865).
10. **Catostomus catostomus** (Forster). *Long-nose Sucker.* St. Lawrence and its tributaries (Fortin 1865).
11. **Catostomus commersonii** (Lacépède). *Common Sucker.* River St. Lawrence and all its tributaries (Fortin 1863); St. Lawrence River below Cape Vincent, at Clayton, and near Ogdensburg, and Racket River at Norfolk (Evermann & Bean coll. 1894); Lake Memphremagog (Evermann & Kendall 1894); River St. Lawrence between New York and Ontario, and Lake Memphremagog (Rathbun & Wakeham 1897); Cape St. Ignace to Quebec (Montpetit 1897).

12. **Erimyzon sucetta oblongus** (Mitchill). *Chub Sucker.* River St. Lawrence and its tributaries (Fortin 1865).
13. **Moxostoma anisurum** (Rafinesque). *White-nosed Sucker.* St. Lawrence River below Ogdensburg (Evermann & Bean coll. 1894).
14. **Moxostoma aureolum** (Le Sueur). *Redhorse.* St. Lawrence and other rivers (Fortin 1865); Montreal (Günther 1868); River St. Lawrence (Montpetit 1897).
15. **Chrosomus erythrogaster** Rafinesque. *Red-bellied Dace.* The only specimens of this species known from the St. Lawrence basin were obtained in the outlet of Rock Pond, near Axton, N. Y., by Professor Evermann May 9, 1901.
16. **Pimephales notatus** (Rafinesque). "*Rock Chub.*" Montreal (Baird coll. 1853); St. Lawrence River at Clayton, Cape Vincent, and near Ogdensburg (Evermann & Bean coll. 1894). Very abundant near Cape Vincent June 28, and full of ripe spawn.
17. **Semotilus corporalis** (Mitchill). *Fall-fish; "Le Mulet; Chevesne; Huitouche; Gardon."* Small streams in Quebec (Baird coll. 1853); River St. Lawrence, Montreal, Quebec (Fortin 1865); Piseco Lake (Mather 1886); Racket River at Norfolk and St. Lawrence River near Ogdensburg (Evermann & Bean coll. 1894); "to as high up as Batiscan, Kiskisink Lakes and Peribonca River" (Chambers 1896); Clyde River at Newport, Vt. (Evermann & Kendall 1894); districts of Quebec and Montreal, from St. Maurice to Lake St. John, to Peribonca, tributaries of the Batiscan, and in Lake St. John (Montpetit 1897).
18. **Semotilus atromaculatus** (Mitchill). River St. Lawrence and nearly all the rivers and streams running into it (Fortin 1865); Lake Memphremagog (Evermann & Kendall 1894).
19. **Abramis crysoleucas** (Mitchill). "*Brême.*" Lake St. Peter and island of Sorel (Montpetit 1897).
20. **Notropis blennius** (Girard). St. Lawrence River at Clayton and near Ogdensburg (Evermann & Bean coll. 1894). Our specimens have been misplaced and this identification is uncertain.
21. **Notropis hudsonius** (Clinton). "*Shiner.*" The most abundant minnow about Cape Vincent, where numerous specimens were obtained by Evermann & Bean. This is there the most popular of all the bait minnows. Examples taken June 28 were in spawning condition. Specimens obtained also at Ogdensburg.
22. **Notropis whipplii** (Girard). St. Lawrence near Cape Vincent (Evermann & Bean coll. 1894).
23. **Notropis cornutus** (Mitchill). *Redfin; "Rose Bream."* River St. Lawrence and nearly all the rivers and streams running into it (Fortin 1865); St. Lawrence River near Ogdensburg (Evermann & Bean coll. 1894); Clyde River, Vt. (Evermann & Kendall 1894); River St. Charles; Bras-Saint-Nicolas; outlet of Lake Megantic, and lakes of canton of Montminy (Montpetit 1897). Specimens also obtained by Professor Evermann May 9, 1901, in the outlet of Rock Pond, near Axton, N. Y.
24. **Notropis atherinoides** Rafinesque. *Slender Minnow.* St. Lawrence River near Cape Vincent and near Ogdensburg (Evermann & Bean coll. 1894). Not common at either place.
25. **Notropis rubrifrons** (Cope). *Red-nosed Minnow.* Racket River at Norfolk and St. Lawrence River below Ogdensburg (Evermann & Bean coll. 1894).
26. **Rhinichthys cataractæ** (Cuvier & Valenciennes). *Long-nosed Dace.* Montreal (Günther 1868).
27. **Rhinichthys atronasus** (Mitchill). *Black-nosed Dace.* St. Lawrence River at Cape Vincent and near Ogdensburg (Evermann & Bean coll. 1894); Clyde River at Newport and Lake Memphremagog, Vt. (Evermann & Kendall 1894).

28. **Couesius plumbeus** (Agassiz). St. Lawrence River at Clayton (Evermann & Bean coll. 1894) and Clyde River at Newport, Vt. (Evermann & Kendall 1894).

29. **Exoglossum maxillingua** (Le Sueur). *Cut-lip Minnow.* St. Lawrence River at Clayton and near Ogdensburg (Evermann & Bean coll. 1894).

30. **Anguilla chrysypa** Rafinesque. "*Eel; L'anguille.*" St. Lawrence River (Richardson 1836); River St. Lawrence and several of its tributaries (Fortin 1862); Racket and Piseco lakes (Mather 1886); Lake Memphremagog (Rathbun & Wakeham 1897); basin of the River St. Lawrence, Quebec, Montreal (Montpetit 1897).

31. **Hiodon tergisus** Le Sueur. *Moon-eye;* "*La Laquaiche.*" Richelieu River at its confluence with the St. Lawrence (Richardson 1836); River St. Lawrence (Fortin 1864); River St. Lawrence, Lake St. Peter, and in the Ottawa (Montpetit 1897).

32. **Clupea harengus** Linnæus. South shore of River St. Lawrence (Fortin 1862).

33. **Pomolobus pseudoharengus** (Wilson). *Alewife;* "*Gasperot.*" Lower part of River St. Lawrence (Fortin 1863); St. Lawrence (Goode 1884); St. Lawrence River near Cape Vincent and below Ogdensburg (Evermann & Bean coll. 1894).

34. **Alosa sapidissima** (Wilson). *Shad;* "*L'Alose.*" River St. Lawrence (Fortin 1862); St. Lawrence River (Goode 1884); River St. Lawrence to Montreal (Montpetit 1897).

35. **Coregonus quadrilateralis** Richardson. *Round White-fish.* Racket and Piseco lakes (Mather 1886); Lake Memphremagog (Evermann & Kendall 1894).

36. **Coregonus labradoricus** Richardson. *Labrador White-fish.* River St. Lawrence and some rivers flowing into it (Fortin 1863); River St. Lawrence (Hallock 1877); Lake Memphremagog (Evermann & Kendall 1894 and Evermann & Smith 1894); Grand Décharge (Chambers 1896); Lake St. John (Chambers 1896), and Lake Memphremagog (Rathbun & Wakeham 1897). Abundant in Chateaugay Lake, from which eight specimens were received December 24, 1900, through the kindness of the late Hon. A. Nelson Cheney and Mr. Grant E. Winchester, of the New York State fish commission. These specimens were each 8 to 9.12 inches long, and all seemed entirely mature. Two are females with apparently ripe eggs.

These specimens are very interesting, and make it increasingly difficult to state clearly the differences between the Labrador and the common white-fishes. The technical characters of these little fish agree in the main with those assigned to the Labrador white-fish. The number of gillrakers (11+17 to 13+20) varies, however, all the way from the correct number for *C. labradoricus* to that of *C. clupeiformis*, thus eliminating that character so far as its specific value is concerned. The well-developed teeth on the tongue, the dark color, the shape of the body, and the small size at which these fish reach maturity are characters indicating their distinctness from *C. clupeiformis.*

37. **Argyrosomus artedi** (Le Sueur.) *Lake Herring.* Thirty-one Mile Lake, Quebec, 60 miles north of Ottawa (D. Dwylie coll. 1897).

38. **Salmo salar** Linnæus. *Salmon.* "*Le Saumon Commune.*" St. Lawrence River to Lake Ontario (Richardson 1836); mouth of St. Lawrence, Saguenay, Mont Florence, Chaudière, and Jacques Cartier (Herbert 1859); Lower St. Lawrence, Rimouski, Grand Metis, etc. (Hallock 1873); St. Lawrence Basin (Hallock 1877); Saguenay River (Roosevelt 1884); St. Lawrence River (Goode 1884); Trinity and Chicoutimi rivers (Roberts 1892); Saguenay, Petit Saguenay, Sainte Marguerite, Eternité, Chicoutimi, Tadousac, Laval, Moisie, Natashquan, La Grande and Petit-Trinity (Montpetit 1897).

39. **Salmo ouananiche** McCarthy. *Ouananiche.* Upper Saguenay (Hallock 1873); Lake St. John, headwaters of the Saguenay, Province of Quebec (Hallock 1877); Saguenay (Roberts 1892); Upper Saguenay River system and Lake St. John (Creighton 1892); Lake St. John, the various rivers flowing into it, and the Grand Discharge: Ouiatchouan, Ouiatchouaniche, and Metabetchuan rivers; also Ashuapmouchouan, Mistassini, and Peribonca rivers and lakes; also Lake Tshotagama and Lake a-Jim (McCarthy 1894); Grand Décharge, Saguenay, Lake St. John, and principal tributaries (Chambers 1896); Lake St. John, Grand Décharge, Chute du Diable, L'Ashuap, and Metabetchuan (Montpetit 1897).

40. **Cristivomer namaycush** (Walbaum). *Lake Trout; "Touladi."* Lake St. John and Lake Metis (Chambers 1896); Lake Memphremagog (Evermann & Kendall 1894, and Rathbun & Wakeham 1897); Lake Champlain, tributaries of Lake St. John to Quebec, Peribonca River, and Province of Quebec to Lake Temiscamingue (Montpetit 1897); Follingsby Pond, near Axton, N. Y. (Evermann coll. 1900).

41. **Salvelinus fontinalis** (Mitchill). *Trout; Le Truite Commune.* Mouth of the St. Lawrence (Herbert 1859); "all of our rivers which flow into the St. Lawrence as far as Lake Ontario, and mouths of a great number of rivers which flow into the Lower St. Lawrence" (Fortin 1862); lakes in the upper Saguenay region and the upper parts of the river tributaries (Creighton 1892); Lake a-Jim and Lac de Belle Riviere (McCarthy 1894); Grand Décharge (Chambers 1896); Ampersand Pond, near Axton, N. Y. (Evermann coll. 1900).

42. **Salvelinus marstoni** Garman. Lac de Marbre, Ottawa County, province of Quebec (Garman 1893); lake near Ottawa, Lac des Isles and Lac à Cassette, Rimouski County (Chambers 1896); Lake Saccacomi and Red Lakes, township of St. Alexis des Monts, Maskinonge County, Quebec (specimens collected by J. W. Titcomb, 1901); Decalonnes township (township of St. Alexis des Monts) Quebec (specimen received by U. S. National Museum in 1886, from Eugene Blackford); Lake Tourille, headwaters of St. Anne River, province of Quebec (specimen received in 1899 by U. S. National Museum from Graham H. Harris); lake in Chernier township, Rimouski County, province of Quebec (2 specimens received in 1896 by U. S. National Museum, from Department of Crown Lands). This trout is probably of wide distribution in the region north of the St. Lawrence River, but definite records are wanting.

43. **Osmerus mordax** (Mitchill). *Smelt; "L'Epelan."* River St. Lawrence as far as Quebec (Fortin 1862); St. Lawrence at least to Quebec (Whiteaves 1873); Lake Memphremagog (Evermann & Kendall 1894); Quebec and Trois Rivieres (Montpetit 1897); Lake Memphremagog (Rathbun & Wakeham 1897).

44. **Umbra limi** (Kirtland). Streams and little rivers of Canada (Fortin 1865).

45. **Esox reticulatus** Le Sueur. *Grass Pike; "Brochet Maillé."* River St. Lawrence (Fortin 1863); Racket Lake (Mather 1886); St. Lawrence River between New York and Ontario (Rathbun & Wakeham 1897); River St. Lawrence (Montpetit 1897).

46. **Esox lucius** Linnæus. *Pike; "Le Brochet."* Basin of the St. Lawrence (Herbert 1859); River St. Lawrence (Fortin 1863); St. Lawrence River (Hallock 1877); Grand Chute, Lake St. John, and Peribonca (Creighton 1892); St. Lawrence River near Ogdensburg (Evermann & Bean coll. 1894); Lake Memphremagog (Evermann & Kendall 1894); Lake St. John, Grand Discharge and many tributary waters (McCarthy 1894); Lake St. John, Grand Décharge, and Peribonca (Chambers 1896); River St. Lawrence between New York and Ontario, and Lake Memphremagog (Rathbun & Wakeham 1897); basin of River St. Lawrence (Montpetit 1897); Follingsby Pond, near Axton, N. Y. (Evermann coll. 1900).

47. **Esox masquinongy** Mitchill. *Muskallunge; "Muskalonge"; "Le Maskinonge."* St. Lawrence River at Thousand Isles (Hallock 1877); St. Lawrence River (Goode 1884); St. Lawrence River between New York and Ontario (Rathbun & Wakeham 1897); basin of the River St. Lawrence (Montpetit 1897); St. Lawrence River near Ogdensburg (Evermann & Bean coll. 1894).

48. **Fundulus diaphanus** (Le Sueur). St. Lawrence River near Cape Vincent and near Ogdensburg (Evermann & Bean coll. 1894). Specimens obtained at Cape Vincent June 28 were full of ripe eggs.

49. **Eucalia inconstans** (Kirtland). Near Montreal (Dawson 1859).

50. **Percopsis guttatus** Agassiz. *Trout Perch.* St. Lawrence River at Cape Vincent (Evermann & Bean coll. 1894).

51. **Scomber scombrus** Linnæus. *Mackerel.* North shore of River St. Lawrence (Fortin 1862).

52. **Pomoxis sparoides** (Lacépède). *Calico Bass; "Le Crapet Calicot."* Waters of Quebec, "Deep-cut," and the Ottawa (Montpetit 1897).

53. **Ambloplites rupestris** (Rafinesque). *Rock Bass; "Le Crapet Vert"; "Crapet Mondoux"; "Brême."* River St. Lawrence (Fortin 1894); waters of Quebec (Montpetit 1897). Common in the St. Lawrence River near Cape Vincent (Evermann & Bean coll. 1894).

54. **Eupomotis gibbosus** (Linnæus). *Common Sun-fish; "Le Crapet Jaune."* Montreal (Fortin 1864); St. Lawrence River between New York and Quebec (Rathbun & Wakeham 1897); Canada (Montpetit 1897). A good many examples in spawning condition were obtained June 28, 1894, by Evermann & Bean near Cape Vincent, and others obtained by them at Ogdensburg.

55. **Micropterus dolomieu** Lacépède. *Small-mouth Black Bass; "L'Achigan Petit Bouche."* St. Lawrence basin (Herbert 1859); Thousand Isles (Roosevelt 1884); Upper St. Lawrence River (Goode 1884); Racket Lake and Partelo Pond, in St. Lawrence County, N. Y. (Mather 1886); St. Lawrence River near Cape Vincent and near Ogdensburg (Evermann & Bean coll. 1894); Lake Memphremagog (Evermann & Kendall 1894); River St. Lawrence between New York and Ontario, and in Lake Memphremagog (Rathbun & Wakeham 1897); basin of the St. Lawrence River and Long Pond, N. Y. (Montpetit 1897); Follingsby Pond near Axton, N. Y. (Evermann coll. 1900). Young black bass, 3 to 12 inches long, were exceedingly abundant at Cape Vincent in June.

56. **Micropterus salmoides** (Lacépède). *Large-mouth Black Bass; "L'Achigan Grand Bouche."* Upper St. Lawrence River (Goode 1884); basin of St. Lawrence (Montpetit 1897); French Creek near Clayton (Evermann & Bean coll. 1894); Follingsby Pond near Axton, N. Y. (Evermann coll. 1900).

57. **Stizostedion vitreum** (Mitchill). *Wall-eyed Pike; "Le Grand Doré."* Montreal and Lower St. Lawrence (Fortin 1864); Lake St. John waters (Creighton 1892); Lake St. John, Grand Décharge, and Peribonca (Chambers 1896); St. Lawrence River between New York and Quebec (Rathbun & Wakeham 1897); basin of the St. Lawrence (Montpetit 1897).

58. **Stizostedion canadense** (Smith). *Sauger; "Le petit Doré."* River St. Lawrence (Fortin 1864); basin of the River St. Lawrence (Montpetit 1897); St. Lawrence River near Ogdensburg (Evermann & Bean coll. 1894).

59. **Perca flavescens** (Mitchill). *Yellow Perch; "La Perchaude."* Quebec (Baird coll. 1853); River St. Lawrence (Fortin 1863); Lake St. John, Grand Discharge, and many tributary rivers (McCarthy 1894); St. Lawrence River at Cape Vincent and near Ogdensburg (Evermann & Bean coll. 1894); Lake Memphremagog (Evermann & Kendall 1894); Lake Memphremagog and River St. Lawrence between New York and Ontario (Rathbun & Wakeham 1897); basin of River St. Lawrence (Montpetit 1897); Follingsby Pond near Axton, N. Y. (Evermann coll. 1900). Very abundant about Cape Vincent.

60. **Percina caprodes** (Rafinesque). *Log Perch.* Small streams in Quebec (Baird coll. 1853); Racket River at Norfolk and St. Lawrence River near Ogdensburg (Evermann & Bean coll. 1894).
61. **Cottogaster cheneyi** Evermann & Kendall. *Cheney's Darter.* Racket River at Norfolk, N. Y. (Evermann & Kendall 1897).
62. **Boleosoma nigrum olmstedi** (Storer). *Johnny Darter.* Small streams of Quebec and at Montreal (Baird coll. 1853); Racket River at Norfolk and St. Lawrence River near Cape Vincent and Ogdensburg (Evermann & Bean coll. 1894). Rather common at Cape Vincent.
63. **Etheostoma boreale** (Jordan). *Northern Darter; "L'Apron."* Montreal (Jordan 1884); basin of River St. Lawrence from Montreal to the Great Lakes (Montpetit 1897).
64. **Etheostoma flabellare** Rafinesque. *Fan-tailed Darter.* Small streams in Quebec (Baird coll. 1853).
65. **Roccus lineatus** (Bloch). *Striped Bass; "Bars."* St. Lawrence as far as Quebec (Richardson 1836); River St. Lawrence and some of its tributaries, Sorel and Crane islands (Fortin 1863); River St. Lawrence to Quebec (Goode 1884); River St. Lawrence up to Sorel (Montpetit 1897).
66. **Cyclopterus lumpus** Linnæus. *Lump-fish.* Shores of the River and Gulf of St. Lawrence (Fortin 1863).
67. **Cottus ictalops** (Rafinesque). *Blob; "Le Chabot."* St. Lawrence River near Cape Vincent and Ogdensburg (Evermann & Bean coll. 1894). Only four specimens obtained, one at Cape Vincent and three at Ogdensburg.
68. **Uranidea gracilis** (Heckel). *Blob; "Le Chabot."* River St. Charles (Montpetit 1897) and Racket River (Mather 1886).
69. **Microgadus tomcod** (Walbaum). *Tomcod; "La petite Morue"; "La Loche."* Basin of the River St. Lawrence (Montpetit 1897).
70. **Lota maculosa** (Le Sueur). *Ling; "La Loche."* River St. Lawrence (Fortin 1863); St. Lawrence River near Ogdensburg (Evermann & Bean coll. 1894); Lake St. John (Chambers 1896); Lake Memphremagog (Rathbun & Wakeham 1897); basin of the aqueduct of Montreal and rivers flowing into Lake St. John (Montpetit 1897).
71. **Pseudopleuronectes americanus** (Walbaum). *Winter Flounder.* River St. Lawrence and several tributaries (Fortin 1862).

NOTES ON THE SILVERSIDES OF THE GENUS MENIDIA OF THE EAST COAST OF THE UNITED STATES, WITH DESCRIPTIONS OF TWO NEW SUBSPECIES.

By W. C. Kendall,
Assistant, United States Fish Commission.

INTRODUCTION.

This paper is primarily the outcome of difficulty encountered in attempting to identify some fresh-water forms of *Menidia* of Florida, which will be referred to in detail on another page. In 1892 the present writer discovered, in a collection made by Mr. Vinal N. Edwards and himself at Woods Hole, a lot of specimens which were then thought to be *M. beryllina;* this discovery was recorded by Kendall & Smith in the Bulletin of the United States Fish Commission for 1899. The Florida examples just mentioned suggesting this form were compared with the Woods Hole specimens, and both with Potomac River fish. This led to the examination of all available specimens of the genus and all the literature on the subject, with the results set forth in these notes. With all the collecting previously done at Woods Hole, it is somewhat remarkable that a form noticeably different from the common silverside and exceedingly common at Woods Hole should so long escape detection, but not more remarkable than subsequent discoveries at the same place by Dr. Hugh M. Smith.

The material upon which the conclusions embodied in this paper are based is comprised in the large collections of the United States National Museum, representing a wide range of localities on the coast; excellent collections from the east coast of Florida, made by Prof. Barton W. Evermann and Mr. Barton A. Bean; west coast of Florida, by Professor Evermann and the writer; Louisiana and Mississippi, by Professor Evermann; the coast of Texas, by Professor Evermann; North Carolina, Potomac River, and Woods Hole, by Dr. Hugh M. Smith; Florida, Georgia, South Carolina, North Carolina, Chesapeake Bay, Potomac River, Delaware Bay, Woods Hole and vicinity, Gloucester, Massachusetts, and the coast of Maine, by the writer; the Potomac River, by Mr. Millard C. Marsh. Hundreds of specimens have been examined and compared, but only a few from the most important localities, taken for the most part at random, are given in the comparative tables.

For encouragement and assistance I am deeply indebted to Dr. Hugh M. Smith, assistant in charge of the Division of Scientific Inquiry, and Prof. Barton W. Evermann, ichthyologist of the United States Fish Commission, and particularly to Mr. B. A. Bean, assistant curator of fishes, United States National Museum, who rendered the Museum collections easily accessible and who was ever ready and willing to give any possible assistance.

In the publication of these notes the main objects in view are—

1. To call attention to an overlooked opportunity for a remunerative and comparatively inexpensive fishing industry and a neglected delicacy in the way of food-fish.

2. To contribute something toward the knowledge of the relationship and natural history of these fishes.

THE SILVERSIDES.

The silversides belong to the family *Atherinidæ* and are represented by three genera on the Atlantic coast of the United States: *Atherina*, *Kirtlandia*, and *Menidia*. The first of these is essentially West Indian, no species of it being positively known to occur farther north than Florida. It may be easily distinguished from the other genera by its less compressed form, the rounder body, and heavier head, flattened and wide on top. *Kirtlandia* more closely resembles *Menidia*, in fact was until recently considered a member of that genus. It may be readily recognized, however, by its gashed or laciniated scales, those of *Menidia* being entire. The scales are also firmer and more glossy than in *Menidia*, which renders this form less desirable as food. *Kirtlandia* is found as far north as Long Island. In early summer it is very abundant in Chesapeake Bay.

The genus *Menidia* is the one with which this paper is particularly concerned. It comprises several species of small slender fishes bearing a broad silvery stripe along the sides, whence their name silversides. One or more species abound along the whole coast from Nova Scotia to Texas. In general appearance they resemble the smelt (*Osmerus*) and in some places are known as "sand smelt" and "green smelt," and are sometimes mistaken for the young of the common smelt, from which they can easily be distinguished by the absence of the adipose fin of the smelt and the presence of a small spinous dorsal fin which the smelt does not possess.

ABUNDANCE.

In the south, silversides abound in the shore waters at all seasons. One form inhabits fresh water in Florida, occurring in the St. Johns River as far up, at least, as Lake Monroe; another fresh-water form occurs about Vicksburg and Edwards, Miss., and Natchez, Tenn. In more northern latitudes in the spring and early summer they appear

in countless numbers along sandy shores, in brackish creeks, channels, and estuaries. One species is found in the Potomac River as far up as Washington.

To illustrate their abundance and the ease with which they can be caught, a few instances may be given: At one time a 15-foot bag seine (Baird collecting seine) was hauled at Morehead City, N. C., on a sand bar. The bag, holding a bushel or more, was filled at every haul. In an arm of Casco Bay, Me., a 75-foot seine of the same kind as the above was hauled in a muddy channel and 2 or 3 bushels taken at a haul; this called forth remonstrances from the inhabitants, who thought it an unwarranted slaughter of young smelts.

Dr. Hugh M. Smith furnishes the following notes regarding the abundance of silverside at Woods Hole during the summer of 1899:

Menidia notata.—"*Brit.*" This is one of the most abundant fishes of southern Massachusetts. It occurs in very large schools in Vineyard Sound, Buzzards Bay, and Nantucket Sound, usually associated with *M. beryllina*. In the Woods Hole region it appears in April, and is found until December. In November, when the schools seem to become larger and denser, the fish is exceedingly numerous in Great Harbor, about the wharves. Examples upwards of 6 inches long are common.

Both species* of silversides are exceedingly abundant about wharves, and on sandy, gravelly, and sometimes grassy shores. At times the seine catch will consist of over 95 per cent silversides; and no seine haul fails to contain some. On August 31, 1899, there were enormous schools along the eastern side of Vineyard Sound at Lambert Cove, and the seine was literally packed with them; one haul contained not less than 20 bucketfuls of uniform size (3 inches). These fishes must be among the most abundant fishes of the region and the most valuable food for many of the other fishes, including squeteague, sea bass (locally called "rock bass"), scup, mackerel, bonito, sea robin, blue-fish, cunner, gar, needle-fish, etc., besides terns and gulls.

These fishes and the anchovies (*Anchovia*) undoubtedly contribute extensively to the food supply of the above-mentioned fishes besides many others southward, and it is not impossible that they furnish the chief subsistence for many of them.

The extent to which the young blue-fish, squeteague, etc., feed upon the silversides suggests the question whether the extensive capture of silversides for commercial purposes be advisable. It might have an unforeseen injurious effect upon the abundance of more valuable fishes. The constantly increasing demand for fish-food has resulted in more extensive fisheries and new and improved appliances for fishing, as well as a market for fishes formerly valueless. All of these things have to some extent helped toward the decrease of the food-fishes, and in conjunction with impassable dams and other obstructions have caused the disappearance of anadromous fishes from some localities. It is impossible to tell the precise effect the disappearance of these fishes from a region may have had on the more permanent residents. Once it was thought that the cod fisheries of the coasts of Maine and Massachusetts were practically inexhaustible. It is noticeable, how-

*Referring to *M. menidia notata* and *M. beryllina cerea*.

ever, that the disappearance of cod from any locality on the Maine coast has been at times coincident with marked scarcity of members of the herring family in the same region.

A study of the reports of the department of marine and fisheries of Canada will reveal the fact that the success of the cod fisheries of the Gulf of St. Lawrence depends directly and absolutely upon the abundance of capelin or herring. A scarcity of either of these fishes is always accompanied by a scarcity of the cod. This is forcibly shown in an examination of the returns from local fisheries. Capelin or herring, as the case may be, may appear at some localities and not at others. In every instance there is a corresponding abundance or scarcity of cod during a season.

The shore cod fisheries of New England were at one time, and for a long time, believed to be declining, and they were. The subsequent increase in some localities can be accounted for in at least two ways: First, to artificial propagation; second, to reappearance of principal food, or perhaps to both. The silverside on the coast of southern New England is analogous to the capelin of the north; in fact, it is known as capelin in some localities. It is possible that in seasons of scarcity of some of the larger fishes of this region there may have been a corresponding though unnoticed scarcity of silversides.

SIZE AND USES.

Silversides are quite commonly designated as "small fry" or "brit." Different species vary in size, and individuals of the same species of course vary according to age. The species of *Menidia* of the Atlantic coast of North America attaining the largest size is *M. menidia notata*, the common silverside of the north, which, so far as known, reaches a maximum length of from 5 to 7 inches. Fish from 4 to 5 or 6 inches in length are not uncommon on the south coast of New England, but usually they are smaller. They swim in immense schools, fish of about the same size generally being found together.

On the California coast certain forms of silversides are of larger size and of considerable commercial importance, especially the "blue smelt" (*Atherinopsis californiensis*) and "little smelt" (*Atherinops affinis*). The first reaches a length of 18 inches, the other 1 foot.

On the Atlantic coast silversides are not of much commercial importance, although they are sold as bait for young blue-fish ("skipjacks") at some places along Long Island Sound, and sometimes appear on hotel bills of fare as "whitebait." When cooked properly they are delicious, and since they are so abundant they ought to contribute largely to the fishing industry and food supply of the Atlantic States.

The usual method of cooking "whitebait" is to roll the fish in cracker crumbs and fry them whole. "Whitebait" is usually 2.5 or 3 inches long. Larger fish may be cleaned like smelts, rolled in cracker crumbs

or in corn meal, and dry-fried. In Newfoundland large quantities of capelin are dried and shipped to London, where they are used as food, largely in the oyster houses. There is a possibility in this method of curing large silversides for the market. As a side venture some method of canning them, in an already established fish-cannery, might pay. All of these things, however, will be the natural outgrowth of a fishery for silversides when the demand for the fish increases.

The fact that silversides are the favorite food of many fishes suggests their use for bait. To this, there are at least two objections: They quickly soften, and they die rather too soon for live bait; but they are used in both ways for bait for young blue-fish and other fishes.

PROTECTION.

There is no doubt that as the excellent food qualities of the silversides become better known, a demand for them will be created that will give rise to extensive fisheries for them, especially as the smelt, to which the silversides is but a little inferior, is growing scarcer. The silversides, being strictly shore fishes, will more quickly feel the effect of extensive drafts upon their numbers than do the pelagic gregarious fishes, like the mackerel and blue-fish.

I have stated that one object of this paper is to call attention to an opportunity for a paying fishery, but it should be a fishery well regulated from the beginning. That such regulations may be intelligent, resulting in the most good to the greatest number, the economic relations of silversides to other fishes should be thoroughly studied, and a possible danger thus averted.

The importance of the subject will warrant emphasizing the fact that fishery regulations should be made before the need for them is established by sad experience. For "all the king's oxen and all the king's men" can never restore exhausted sea fisheries.

Feasible legislation is, however, a difficult matter, and fishery laws are too often of little other use than padding for the statute books. Legislation should be founded upon a thorough knowledge of the habits of the fish and their relation to other species. As with other fishes, it seems desirable that silversides should be unmolested during the period of the height of their spawning season, and inasmuch as they are found in schools of fairly uniform-sized fish, it would be an easy matter for the fisherman to avoid catching small fish, which would allow a size limit to be imposed.

BREEDING HABITS.

There are no external marks to distinguish sex, even in the breeding season. The females average larger than the males, and in a school, contrary to the usual rule among many fishes, seem to be more numerous. Out of 380 specimens of *M. menidia* from Woods Hole

which were examined, 204 were females and 146 males. The females averaged 4.05 inches, the males 3.67 inches in length.

These fish breed during the spring and early summer, and doubtless some of them throughout the summer. During the first week in April the common silverside (*M. menidia*) was found full of spawn at Morehead City, N. C. They spawn on the sand and in the sedge in shallow water close to shore.

In a brief paper,* published nearly twenty years ago, Ryder gave some interesting observations upon the eggs of the silversides which he called *Menidia notata*. He said:

> The mature eggs of *Menidia notata* measure about a line in diameter, and are covered with a thick, strong egg membrane. When first taken from the parent fish, the germinal matter of the ovum is spread mainly over the surface of the vitellus, and in the latter a number of highly refringent oil globules of various sizes are embedded. In the space of ten hours the batch of ova studied by the writer had the germinal disk independently of impregnation.
>
> Probably the most striking peculiarity about the ova of *Menidia* is the garniture of threads which are attached to one pole of the egg, covering a very small area of insertion on the outer surface of the egg membrane. There are four of these filaments, and when the eggs are first emitted they are coiled around the egg membrane externally in a spiral manner. Very soon after oviposition they commence to uncoil from around the egg, and when a number are stirred or shaken about in a small dish they soon become entangled together so as to hang together in bunches or strings. These threads are about eight times the length of the diameter of the ovum, and are apparently composed of the same tough material as that which enters into the formation of the egg membrane itself. In the immature condition, and when the ovarian egg is still far from full grown, I find the threads present on the outside of the zona or membrane, closely adherent to the latter. In this condition the membrane is relatively thicker than in more mature eggs, and the nucleus is quite conspicuous at the center of the immature vitellus.
>
> The filaments at the point of attachment to the egg membrane are somewhat enlarged, but have no bulbous base as in the case of those found on the ova of the silver gar. The egg is heavier than sea water, the oil drops embedded in the yolk seeming to have no tendency to buoy them up.
>
> * * * * * * *
>
> The eggs being taken at night renders it possible that the species is a nocturnal spawner, while the singular threads or filaments may be the means by which the parent fish is enabled to suspend its ova to some fixed support in the water as they are emitted from the oviduct. This might be accomplished by the female while the eggs were expelled by simply passing her body over the stems or leaves of marine plants in her vicinity. This affords an explanation of the remarkable threads which are attached to and at first encircle the egg. We can not escape the conclusion, at any rate, that these threads are of the nature of a protective contrivance either to suspend the eggs to foreign objects or else to entangle them together in masses, such as we find to be the case with the eggs of the silver gar, where the filaments are, however, scattered over the whole surface of the egg.

Professor Ryder noted that a full-grown female of this species would not yield more than 300 eggs; but in this respect, as well as in regard to the number of filaments, the observations of Prof. W. J. Moenk-

*On the thread-bearing eggs of the silversides (*Menidia*), by John A. Ryder (Bulletin of the U. S. Fish Commission 1883, 193).

haus are so different that it seems likely that the two observers may have examined different species. This supposition is also warranted by the fact that the specimens came from different localities. Professor Moenkhaus says:

Menidia notata.—Eggs were obtained in abundance from June 1 to July 2, 1901. At Cold Spring Harbor eggs were taken until July 15. The eggs are usually not perfectly spherical, but have various slight irregularities. At one pole there is a tuft of about 50 filaments, very elastic and several times the diameter of the egg in length. These become matted together, forming a central core around which the eggs are clustered like grapes around the stem. The protoplasmic disk is comparatively large. The eggs when ripe are exceedingly easily expressed, so that the fish must be handled rather carefully. A good-sized female yielded 1,413 eggs.

Dr. Bumpus has published the following notes* regarding the spawning time of silversides on Cape Cod:

Two species of *Menidia* (*gracilis* and *notata*) abound in the neighborhood of the laboratories. The following has been taken from the notes kindly furnished by Dr. C. Judson Herrick:

"On June 5, 1896, Mr. Edwards found *Menidia notata* spawning at Hyannis in vast numbers. At this time the fish had selected a point in the beach grass above the low-tide level, and at low tide the eggs were consequently exposed to the sun and dried. Mr. Edwards noted great quantities of spawn and milt, and collected about a quart of the former.

"During the last days of June and the first ten days of July of the present year the fish were very scarce, though Dr. Herrick found a few ripe females and a very few males. The eggs adhere to each other in thick, ropy masses, and to any foreign object with which they come in contact by means of long threads. Both fertile and unfertile eggs sink to the bottom, and the first cleavage plane appears in about one hour. The eggs may be artificially hatched in jars of running water, the period of incubation being ten days. The young fish, which carry a small yolk-sac, are about 6 mm. in length. Fry were skimmed from the surface of the harbor on July 4, and measured 1.5 cm. in length. On July 9 fry similarly taken measured 2.25 cm. in length.

"The eggs of *Menidia gracilis* resemble those of *Menidia notata*, but the species seems to breed later, since many ripe females were taken during the first week in July. The eggs, however, do not undergo artificial fertilization as readily as those of the first species."

FOOD OF THE SILVERSIDES.

The silversides subsist upon minute animal and vegetable organisms, particularly small crustaceans, and doubtless devour a great many floating eggs of other fishes. Dr. Smith informs me that he has found several with young lobsters about three-fourths inch long in their stomachs. As may be seen in the appended tables, the bulk of the food of the common northern silverside consists of small crustaceans, but they eat whatever meat falls within their reach, not disdaining the eggs and young of their own kind. That they feed both at the surface and at the bottom is clearly shown by the character of the food. Copepods, other free-swimming crustaceans, and insects are frequently eaten; and often mud, algæ, and diatoms from the bottom are found in their stomachs.

*H. C. Bumpus, Science, N. S., vol. VIII, No. 207, p. 4, December 16, 1898.

The following detailed data show the nature of the stomach contents of series of silversides from Woods Hole, collected at frequent intervals between April and December, 1900, by Mr. Vinal N. Edwards. Incidentally, the length, sex, and spawning condition are given.

Stomach contents of silversides from Woods Hole.

[Great Harbor, April 1, 2 p. m.; bottom grass and mud; temperature of water 37° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	Inches.			
1	4.12	Male	Gonads small	Copepods.
2	4.50	Female	do	Fragment 1.5 inches long of slender fish.
3	4	Male	do	Full of copepods.
4	4.25	Female	do	Do.
5	4.25	do	do	Do.
6	3.50	Male	do	Copepods and 1 amphipod.
7	3.37	Female	do	Empty.
8	3.75	Male	do	Full of copepods.
9	3.12	Female	do	Empty.
10	2.75	Male	do	Do.

[Eel Pond, April 5, 10 a. m.; bottom grass and mud; temperature of water 38° F.]

1	4.75	Male	Gonads well advanced	Full of small copepods.
2	4.12	Female	do	Do.
3	4.37	Male	do	Do.
4	4	Female	do	Copepods and mysis.
5	4.06	do	do	Full of copepods.
6	4.25	do	do	Do.
7	3.75	do	do	Mysis and copepods.
8	3.75	do	do	Distended with copepods.
9	4.94	Male	do	Mysis and copepods.
10	4	Female	do	Full of copepods.

[Great Harbor, April 12, 10 a. m.; bottom grass and sand; temperature of water 39° F.]

1	4.06	Female	Gonads well advanced	Copepods and mysis.
2	3.62	do	do	Copepods.
3	4.25	Male	do	Copepods and 1 mysis.
4	3.75	do	do	Mysis and a few copepods.
5	3.56	do	do	Few copepods.
6	4.37	Female	do	Do.
7	4.31	do	do	Full of copepods.
8	3.50	Male	do	Copepods and mysis.
9	2.94	do	do	Few copepods.
10	3.12	Female	do	Do.

[Great Harbor, April 16, 10 a. m.; bottom grass and mud; temperature of water 40° F.]

1	4.56	Female	Gonads advanced	Full of small copepods.
2	4	do	Gonads small	Do.
3	4.25	do	Gonads large	Copepods and mysis.
4	4	do	Well advanced	Full of mysis.
5	4.62	Male	do	Distended with copepods.
6	4	Female	Gonads large	Do.
7	3.56	Male	do	Full of mysis.
8	3.37	do	do	Full of copepods.
9	3.56	do	do	Do.
10	3.12	do	do	Do.

[Eel Pond, April 20, 11 a. m.; bottom mud and eelgrass; temperature of water 44° F.]

1	3.75	Male	Gonads large	Copepods.
2	4.37	Female	Well advanced	Few copepods and mysis.
3	3.56	Male	do	Full of copepods.
4	4.18	Female	Gonads small	Do.
5	4	do	Well advanced	Full of mysis and copepods.
6	3.87	do	Gonads small	Full of copepods.
7	3.43	Male	do	Do.
8	4	do	do	Do.
9	3.31	Female	Gonads large	Empty.
10	3.87	do	Gonads small	Full of copepods.

Stomach contents of silversides from Woods Hole—Continued.

[Great Harbor, April 27, 2 p. m.; bottom sand and eelgrass; temperature of water 46° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	Inches.			
1	4.56	Female...	Advanced	Full of mysis.
2	4.12	.....do....	.....do	Do.
3	4	.....do....	Well advanced	Full of copepods.
4	4	Male	Advanced	Full of mysis.
5	4.25	.....do....	.....do	Distended with mysis.
6	3.81	Female...	Gonads small	Full of copepods.
7	3.62	Male	Well advanced	Do.
8	3.81	.....do....	.....do	Mysis.
9	4	Female...	Advanced	Full of copepods.
10	3.81	.....do....	Well advanced	Copepods.

[Eel Pond, May 1, 10.30 a. m.; bottom mud and eelgrass; temperature of water 47° F.]

1	4.37	Female...	Well advanced	Mysis.
2	4.25	.....do....	Gonads small	Full of mysis.
3	4.18	Male	Gonads large	Full of copepods with some mysis.
4	4.12	Female...	Gonads small	Full of mysis.
5	3.37	.....do....	.....do	Copepods.
6	3.75	.....do....	.....do	Copepods and mysis.
7	4.31	.....do....	.....do	Do.
8	3.87	Male	.....do	Full of copepods and mysis.
9	3.75	.....do....	.....do	Full of mysis.
10	4.25	Female...	.....do	Do.

[Great Harbor, 2.30 p. m.; bottom eelgrass and sand; temperature of water 48° F.]

1	4	Male.....	Gonads large	Full of copepods.
2	4.37	Female...	Well advanced	Do.
3	4.31	Male.....	Advanced	Do.
4	3.75	Female...	Gonads small	Do.
5	4.5	.....do....	.....do	Do.
6	3.56	Male.....	Gonads large	Do.
7	3.75	Female...	Gonads small	Copepods.
8	3.87	Male.....	Gonads large	Do.
9	3.25	.....do....	Well advanced	Empty.
10	2.94	.....do....	Gonads large	Do.

[Eel Pond, May 16, 10.30 a. m.; bottom eelgrass and sand; temperature of water 52° F.]

1	3.87	Female...	Advanced	Distended with copepods.
2	3.87	.....do....	.....do	Full of several species of winged insects.
3	3.87	.....do....	Gonads small	Distended with copepods.
4	3.87	.....do....	.....do	Empty.
5	3.5	Male.....	Advanced	Full of copepods.
6	3.31	Female...	Gonads large	Empty.
7	3	Male.....	Advanced	Do.

[Great Harbor, May 25, 10 a. m.; bottom grass and sand; temperature of water 55° F.]

1	3.81	Female...	Ripe	Full of copepods.
2	4.37	.....do....	Nearly ripe	Do.
3	4.25	.....do....	Well advanced	Distended with copepods.
4	4.18	.....do....	Ripe	Do.
5	3.56	.....do....	.....do	Few copepods.
6	3.87	Male.....	.....do	Full of copepods.
7	3.37	.....do....	.....do	Very few copepods.
8	3.5	.....do....	.....do	Copepods.
9	3.62	Female...	Well advanced	Few copepods.
10	2.75	Male.....	Ripe	Full of copepods.

Stomach contents of silversides from Woods Hole—Continued.

[Eel Pond, May 30, 2 p. m.; bottom grass and mud: 10 bushels of fish taken; temperature of water 56° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	Inches.			
1	4.5	Female	Ripe	Distended with copepods.
2	4.18	Male	do	Full of copepods.
3	4.43	Female	do	Do.
4	4.31	do	do	Distended with copepods.
5	4.31	do	Advanced	Do.
6	3.43	Male	Ripe	Copepods.
7	3.18	do	do	Do.
8	3.12	do	do	Full of copepods.
9	3.25	Female	do	Copepods.
10	2.87	Male	do	Few copepods.

[Great Harbor, June 9, 10.30 a. m.; bottom grass and sand; temperature of water 60° F.]

1	4	Female	Ripe	Copepods.
2	4.62	do	do	Distended with copepods.
3	3.87	do	do	Few copepods.
4	3.94	do	do	Do.
5	4	Male	do	Full of copepods.
6	3.87	do	do	Copepods.
7	3.87	Female	Advanced	Do.
8	3.5	do	Ripe	Do.
9	3.62	do	do	Very few copepods.
10	2.75	Male	do	Full of copepods.

[Eel Pond, June 11, 11 a. m.; bottom grass and mud; no silversides seen at the surface for three weeks; temperature of water 62° F.]

1	4.5	Female	Ripe	Few copepods.
2	4.25	do	Well advanced	Full of copepods.
3	4.37	do	Ripe	Do.
4	4.5	do	Well advanced	Do.
5	4.43	do	Ripe	Do.
6	4.43	do	Nearly ripe	Few copepods.
7	4.12	do	Ripe	Very few copepods.
8	4	do	Advanced	Distended with copepods.
9	3.37	Male	Ripe	Copepods.
10	2.87	do	do	Do.

[Katama Bay, June 15, 11 a. m.; bottom sand and stones; fish very scarce, but 20 taken in 5 sets of seine; temperature of water 65° F.]

1	5.25	Female	Ripe	Full of Menidia eggs.
2	5.18	do	do	Eggs with embryos; amphipods.
3	4.5	do	do	Empty.
4	4.81	do	do	Full of small ova with embryos.
5	3.94	do	do	?
6	4.25	do	do	Empty.
7	3.81	do	do	Do.
8	3.37	Male	do	Some small ova with embryos.
9	3.43	do	do	Copepods.
10	3.25	do	do	Few copepods and Menidia eggs.

[Eel Pond, June 23, 10 a. m.; bottom grass and mud; no silversides seen at the surface; temperature of water 64° F.]

1	4.5	Female	Well advanced	Full of copepods.
2	4.75	do	do	Copepods.
3	4.37	do	do	Do.
4	4.5	do	do	Do.
5	4.25	?		Full of copepods.
6	4.37	?		Do.
7	4	Female	Well advanced	One small annelid.
8	3.75	do	do	Full of Menidia eggs.
9	2	Male	do	Full of copepods.
10	2.43	Female	do	Do.

Stomach contents of silversides from Woods Hole—Continued.

[Great Harbor, June 30, 1 p. m.; bottom grass and sand; silversides scarce; temperature of water 65° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	Inches.			
1	4.5	Female	Nearly ripe	Copepods and Menidia eggs.
2	4.5	do	Ripe	Menidia eggs, copepods, mysis.
3	3.56	do	do	Empty.
4	4.18	do	Not well advanced	Few mysis.
5	4.06	do	Well advanced	Empty.
6	3.37	Male	Ripe	Few copepods.
7	3.31	do	do	Very few copepods.
8	3.12	do	do	Empty.
9	3.62	do	do	Copepods.
10	3.37	Female	do	Empty.

[Hadley Harbor, July 5, 2 p. m.; bottom grass and mud; silversides very scarce; temperature of water 66° F.]

1	4.56	Female	Well advanced	Few mysis.
2	4.18	do	Spent	Full of mysis.
3	3.5	Male	Well advanced	Few copepods.
4	4.37	Female	Spent	Full of young squid (Loligo).
5	3.87	do	do	Empty.
6	3.68	do	do	Do.
7	3.81	do	do	Few mysis.
8	3.75	do	do	Empty.
9	3.5	Male	Well advanced	Few mysis.
10	3.43	do	do	Empty.

[Katama Bay, July 13, 11 a. m.; bottom sand and weeds; silversides very abundant; temperature of water 72° F.]

1	5.5	Female	Spent	Small crustaceans.
2	4.62	Male	Gonads large	Small crustaceans and 1 shrimp (Crangon).
3	4.06	do	do	Empty.
4	3.94	Female	Spent	?
5	4	Male	Gonads large	Algæ and Menidia eggs.
6	4	Female	Spent	?
7	3.56	Male	Gonads large	Empty.
8	3.5	do	do	Some small crustaceans.
9	3.5	Female	do	Alga and fish egg (Menidia).
10	3.43	do	do	

[Great Harbor, July 17, 11 a. m.; bottom eelgrass; temperature of water 70° F.]

1	4.68	Female	Spent	Empty.
2	4.43	do	do	Very few copepods.
3	4.81	do	do	Annelid setæ and algæ.
4	4.31	do	do	Do.
5	4.5	do	do	Do.
6	3.87	do	do	Larval crabs.
7	3.81	Male	do	Do.
8	3.5	do	Gonads large	Do.
9	3.62	Female	Spent	Empty.
10	3.18	Male	do	Annelid setæ?

[Katama Bay, July 27, 1 p. m.; bottom sand and gravel; temperature of water 72° F.]

1	4.62	Male	Spent	Embryo worms?
2	4.56	Female	do	
3	4.37	do	do	
4	5	do	do	Little algæ.
5	4.25	do	do	Empty.
6	4			
7	4.25	Female	Spent	Eggs and embryo worms? Larval decapods and other species.
8	4.37	do	do	
9	3.62	Male	do	Eggs and embryo worms? Larval decapods and other species.
10	3.75	do	do	Do.

Stomach contents of silversides from Woods Hole—Continued.

[Great Harbor, July 31, 10 a. m.; bottom sand and grass; silversides very scarce; temperature of water 71° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	Inches.			
1	4.5	Female	Spent	Empty.
2	4	Male	do	Do.
3	4.06	do	do	Very few amphipods.
4	4.12	Female	Gonads small	Empty.
5	4.75	Male	Gonads very small	
6	4.75	Female	do	Do.
7	4.12	Male	do	Annelid setæ and other material?
8	3.5	do	Gonads large	Small mysis.
9	3.43	do	Gonads small	Empty.
10	2.87			Do.

[Katama Bay, August 8, 12 m.; bottom sand and gravel; silversides very scarce; temperature of water 73° F.]

1	4.5	Female	Spent	Full of sand and diatoms.
2	4.5		do	1 menidia 1.5 inches long.
3	4.37	Male	do	Full of sand and diatoms.
4	4.37	do	do	Do.
5	4			Do.
6	4.37	Female	Spent	Empty.
7	4.31	do	do	Full of sand and diatoms.
8	4.25	do	do	Do.
9	4.25	do	do	Do.
10	4.25	do	do	Do.

[Katama Bay, August 15, 1 p. m.; bottom sand and gravel; very many silversides; temperature of water 70° F.]

1	4.68	Male	Spent	Full of fine algæ.
2	4.56	Female	do	1 shrimp.
3	5.18	do	do	Small amount fine algæ.
4	4.62	do	do	Full of amphipods.
5	4.5	Male	do	Empty.
6	4.18	Female	do	Do.
7	4.25	do	do	Do.
8	4	Male	do	Do.
9	3.37	do	do	Do.
10	2.81	do	do	Do.

[Woods Hole, August 25, 2 p. m.; bottom sand and eelgrass; silversides very plenty; temperature of water 72° F.]

1	4.06	Female	Spent	Fine algæ.
2	4.31	do	do	Empty.
3	3.43	do	do	Do.
4	3.18	Male	do	Fine algæ.
5	3.5	Female	do	Empty.
6	3	Male	do	Fine algæ.
7	3.31	do	do	Full of copepods.
8	3.06	do	do	Do.
9	2.87	Female	do	Empty.

[Katama Bay, August 29, 2 p. m.; bottom sand and gravel; silversides very plenty; temperature 73° F.]

1	4.5	Female	Spent	Empty.
2	3.81	do	do	Do.
3	3.5	do	do	Do.
4	3.37	do	do	
5	3.37		do	Amphipods.
6	3.12	Male	do	Copepods.
7	3.25		do	Empty.
8	3	Female	do	Copepods.
9	3	Male	do	Empty.
10	2.75	Female	do	Fragments of minute crustaceans.

Stomach contents of silversides from Woods Hole—Continued.

[Katama Bay, September 11, 1 p. m.; bottom sand and gravel; silversides very plenty; temperature of water 72° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	Inches.			
1	3.75	.....	Spent	Empty.
2	3.5	Male	do	Do.
3	3.37	do	do	Do.
4	3.25	Female	do	Mysis?
5	3.18	Male	do	Do.
6	3	Female	do	Do.
7	2.87	Male	do	Full of minute copepods and Cladocera.
8	2.87	.....	do	
9	3.18	Female	do	Empty.
10	2.81	do	do	Do.

[Katama Bay, September 24, 2 p. m.; bottom sand and grass; silversides very plenty; temperature of water 65° F.]

1	4.06	Female	Gonads small	Small shrimp.
2	3.81	do	do	Empty.
3	4.87	do	do	Do.
4	3.37	Male	do	Few young prawns (Pandalus).
5	3.5	.....	do	Do.
6	3.62	.....	do	Do.
7	3.62	.....	do	Wasp and several species of diptera.
8	3.5	Male	do	Young prawns.
9	3.5	do	do	Do.
10	3	do	do	Empty.

[Wareham River, September 25, 1 p. m.; bottom mud and grass; silversides very plenty; temperature of water 66° F.]

1	5	Male	Gonads very minute	Empty.
2	5	do	do	Do.
3	5	Female	do	Small shrimp.
4	5	do	do	Winged ants and diptera.
5	5.5	Male	do	Empty.
6	5	Female	do	Do.
7	5	do	do	Prawn.
8	4.75	do	do	Empty.
9	4.87	Male	do	Do.
10	4.25	do	do	Ants.

[New Bedford, October 5, 11 a. m.; bottom mud and algæ; silversides very plenty; temperature of water 65° F.]

1	3.87	Male	Gonads very small	Winged ants.
2	4.06	do	do	
3	3.75	do	do	Empty.
4	3.43	do	do	Young prawns.
5	3.68	do	do	Ant.
6	3.5	Female	do	Do.
7	3.87	do	do	Young prawn.
8	3.5	Male	do	Empty.
9	3.68	do	do	
10	3.18	.....	do	Amphipods.

[Woods Hole, October 11, 10 a. m.; bottom grass and sand; silversides very plenty; temperature of water 64° F.]

1	4.37	Female	Gonads large, diseased	Young prawns.
2	3.43	Male	Gonads small	Do.
3	3.5	do	do	Do.
4	3.5	do	do	Do.
5	3.5	.....	do	Winged ants.
6	3.31	Male	do	Empty.
7	3.31	Female	do	Do.
8	3.25	Male	do	Do.
9	3.37	do	Gonads very small	Do.
10	2.62	.....	.....	Do.

Stomach contents of silversides from Woods Hole—Continued.

[Katama Bay, October 20, 11 a. m.; sand and gravel; silversides very plenty; temperature of water 57° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	Inches.			
1	4.18	Female	Gonads small	Empty.
2	4.	Male	do	Vegetable fiber, sand, many diatoms (*Pleurosigma*).
3	4.12	do	do	Fair-sized prawns.
4	3.94	do	do	Algæ and diatoms.
5	4	do	do	Filled with diatoms of different kinds.
6	3.75	Female	do	Distended with ooze and diatoms (*Pleurosigma*).
7	3.56	Male	do	Do.
8	3.43	Female	do	Fine algæ.
9	3.43	do	do	Distended with diatoms, principally *Pleurosigma*.
10	3.12	Male	do	Do.

[Eel Pond, November 5, 10 a. m.; bottom mud and grass; temperature of water 56° F.]

1	4.62	Female	Gonads very small	Small prawns (*Pandalus*).
2	4	do	do	Empty.
3	3.75	do	do	Brown ooze and diatoms.
4	4.25	do	do	White ooze and diatoms.
5	4	Male	do	Empty.
6	4.06	Female	do	Brown ooze and diatoms of several kinds.
7	4	do	do	Do.
8	3.87	do	do	Do.
9	3.75	do	do	Do.
10	3.62	do	do	(?)

[Great Harbor, November 13, 10 a. m.; bottom sand and grass; silversides very abundant; temperature of water 50° F.]

1	5.25	Female	Gonads very small	1 young prawn.
2	5.75	do	do	Do.
3	5.25	do	do	Do.
4	5.25	do	do	Do.
5	5.5	do	do	Empty.
6	5.12	do	do	Do.
7	5.18	do	do	Do.
8	4.06	Male	do	1 young or small prawn.
9	4.87	do	do	2 small prawns.
10	4	Female	do	1 small prawn.

[Eel Pond, November 15; silversides very abundant.]

1	5.87	Female	Gonads small	2 small prawns.
2	5.75	do	do	1 small prawn.
3	5.5	do	do	Do.
4	5.43	do	do	Do.
5	5.5	do	do	Empty.
6	5.18	do	do	Do.
7	5.25	do	do	1 small prawn.
8	5.37	Male	do	Do.
9	5.06	do	do	Do.
10	4.87	do	do	Empty.

[Eel Pond, November 20, 2 p. m.; bottom grass and mud; silversides very abundant; temperature of water 49° F.; very slender fish.]

1	5.37	Female	Gonads very small	3 prawns, largest 1¼ inches long.
2	4.87	do	do	2 prawns.
3	4	do	do	Empty.
4	4	do	do	Few copepods.
5	3.62	do	do	Some algæ and a few fish eggs.
6	3.5	do	do	Few small fish eggs.
7	3.25	do	do	Empty.
8	3.5	Male	do	(?)
9	3.37	do	do	Empty.
10	2.87	do	do	Do.

Stomach contents of silversides from Woods Hole—Continued.

[Off the dock, Woods Hole, December 7, 2 p. m.; fish at surface; temperature of water 45° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	Inches.			
1	3.43	Female...	Gonads very small.....	Empty.
2	3.37	.....do	.....do	Do.
3	3.43	Male	.....do	Do.
4	3.5	.....do	.....do	Do.
5	3.37	.....do	.....do	Do.
6	3.37	Female...	.....do	Do.
7	4	Male.....	.....do	Do.
8	3.43	.....do	.....do	Do.
9	3	Female...	.....do	Do.
10	3.25	?	.....do	Do.

[Off the dock at Woods Hole, December 21; silversides very abundant at the surface; temperature of water 36° F.]

1	3.37	Female...	Gonads very small.	Empty.
2	3.37	Male	.....do	Do.
3	3.25	.....do	.....do	Do.
4	3.37	.....do	.....do	Do.
5	3.43	Female...	.....do	Do.
6	3.75	?.....	.....do	Do.
7	3.25	Female...	.....do	Do.
8	3.5	.....do	.....do	Do.
9	3.18	.....do	.....do	Do.
10	2.75	Male	.....do	Do.

DESCRIPTIONS AND SYNONYMY.

As regarded by Jordan & Evermann in Fishes of North and Middle America, the genus *Menidia* now includes ten species and one subspecies in the United States, five of which and the subspecies are found on the Atlantic coast. These are *M. gracilis*, *M. gracilis beryllina*, *M. peninsulæ*, *M. audens*, *M. notata*,* and *M. menidia*.

An examination of a large series of specimens from localities ranging from Halifax, Nova Scotia, to Texas and comparison with the types of some of the species force the conclusion that a readjustment of the nomenclature is necessary. On the Atlantic coast the species are at present arranged in two groups, one of which is characterized by a long anal fin, the other by a comparatively short one. The first group comprises *M. menidia* and *M. notata;* the second *M. gracilis*, *M. gracilis beryllina*, *M. peninsulæ*, and *M. audens*.

In the following pages are given a key to the eastern United States species, a redescription of each species, notes and references having an important bearing on the question of their relationship, and tables of measurements from a number of localities.

Although the different forms when mixed together are readily distinguished by the eye, it is difficult to represent their differences by measurements or figures. The differences are small, and to show them in comparative tables requires a larger series of each form than has been accessible. The depth is exceedingly variable, depending upon a variety of circumstances. For instance, a fish in spawning condition will be far deeper than one not in that condition.

*On page 2840, part III, Jordan & Evermann state that owing to the perfect intergradation between specimens from Florida to Nova Scotia, this form should stand as a subspecies of *M. menidia*.

A careful study of many specimens shows that in the same species from different localities some differences are noticeable. These differences are not individual variation, neither are they constant enough to constitute distinct species, nor will the conditions permit of their being called subspecies. They are rather group differences, constituting what perhaps may be termed geographical races.

It might be asked what is meant by "geographical race." This is difficult to explain, but as intended to be understood here is, as said before, a group of slight variation not satisfying the conditions of species or subspecies—these two being interpreted as (1) a form between which and another closely related form a structural gap exists; (2) one of two closely related forms, one of which has sprung from the other, between which there is no gap, but the differences grade into each other through different localities. A subspecies may be termed an incipient species. According to this definition, then, a "race" may be called an incipient subspecies; in other words, an indication of how a subspecies may originate—through some change in environment. To illustrate: *M. peninsulæ*, occurring at Pensacola (the type locality) and at Indian River, Florida, each locality group differing somewhat from the other should intergrade through successive localities to form a subspecies at Indian River. As a matter of fact, they can not be told apart; but intermediate groups, occupying localities of somewhat different conditions, differ slightly as groups but not always sufficiently as individuals to cause even a suspicion of another species. There may even be groups intervening which do not differ from the typical species.

Key to the species of Menidia of the east coast of the United States.

(This key will apply exactly only to those close to the typical examples. Difficulty will be found with the intergrading or mixed forms.)

a. Anal rays 15 to 17, rarely 19; scales 38 to 41.

b. Snout equal to or longer than eye; anal base shorter than head.

c. Body generally deep, depth 4.5 to 5.5 in length to base of the caudal. Light colored; often somewhat speckled on sides; large salt-water form. Eastern Florida to Texas ..... *M. peninsulæ.*

cc. Body generally slender, depth 5 to 7 in length to base of caudal; small fresh-water forms.

d. Origin of spinous dorsal nearer base of caudal than tip of snout; depth 6. Small, light colored, fresh-water form. Lower Mississippi Valley ..... *M. audens.*

dd. Origin of spinous dorsal midway between tip of snout and base of caudal;* depth 5 to 7. Small, usually dark colored, fresh-water form. Florida. *M. peninsulæ atrimentis.*

bb. Snout mostly shorter than eye; anal base longer than head; body compressed laterally. Potomac River ..... *M. beryllina.*

e. Snout blunter than the above; body rather round and caudal peduncle usually shorter. Coastwise, Massachusetts to South Carolina ..... *M. beryllina cerea.*

aa. Anal rays 20 to 27; scales 39 to 50–8 to 10.

f. Origin of spinous dorsal nearer base of caudal than tip of snout; scales 39 to 45–7 or 8 ..... *M. menidia.*

ff. Origin of spinous dorsal about midway between tip of snout and base of caudal; scales 45 to 50–8 to 10 ..... *M. menidia notata.*

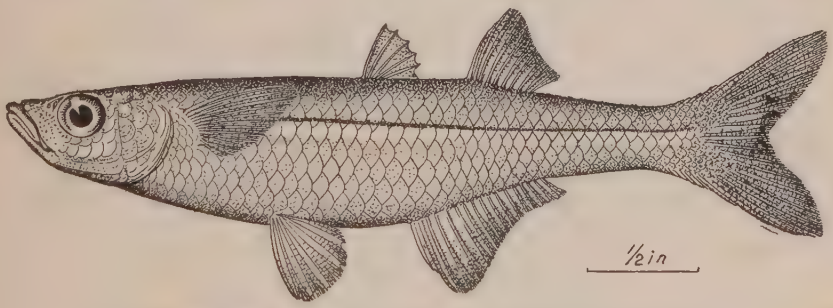
*This character holds strictly good in our typical specimens from the east coast of Florida and St. Johns River, but the majority of those from "Salt Lake," west coast of Florida, have the fin somewhat nearer caudal, in this respect approaching *M. audens.*

Menidia peninsulæ (Goode & Bean).

Chirostoma peninsulæ Goode & Bean, Proceedings of U. S. National Museum 1879, 148.
Menidia peninsulæ, Jordan & Gilbert, Proceedings of U. S. National Museum 1882, 266, and Synopsis, 407, 1883; Jordan & Evermann, Fishes of North and Middle America, 797, 1896.

This is the most common silverside of Florida and the Gulf States; found, so far as now known, only in salt water. From the different localities they differ considerably in appearance, according to their environment. On clear, sandy beaches they are very light colored; in weedy places, often thickly punctate with black, giving them a dusky appearance. In the original description specimens from Lake Monroe were included with *M. peninsulæ*. They are found to differ in some respects, and are presented in this paper under another head. *M. peninsulæ* attains the largest size of the species with short anal fins. We have specimens from both coasts of Florida and from Louisiana, Mississippi, and Texas.

This species most clearly resembles *M. beryllina*, from which it differs chiefly in the longer snout, which equals eye; the base of the anal mostly shorter than the head, never longer, and its larger adult size. Color, as in *M. beryllina;* from some localities darker than the typical Potomac River fish. Total length 3.50 inches; head 4.20 in length without tail; depth 5.50 in same; eye 3 in head; snout 3 + in same; D. v–i, 8; A. i, 16; scales 39–8. From one of the type specimens. Color, light greenish; edges of scales with dark dots; lips and top of head dusky; a dusky streak along base of anal.



Menidia peninsulæ (Goode & Bean). Figure from a specimen from Titusville, Fla.

Specimens from Pensacola (type and cotypes) range in measurements as follows: Total length 2.5 to 3.75 inches; head 4 to 4.3; depth 4.5 to 5.5; eye 3 + to 3.16; snout 3+ to 3.16; D. iv to vi, i, 8 to 10; A. i, 15 to 17; scales 38 to 43–8 to 9.

From Wechawatchee River, Hernando County: Total length 2.75 to 3.25 inches; head 4 to 4+; depth 5 to 5.5; eye 3 to 3+; snout 3 to 3+; D. iv to v, i, 8 or 9, mostly iv–i, 8; scales 39 to 41.

From Tarpon Springs, Florida: Total length 2.12 to 2.87 inches; head 3.4 to 3.75; depth 4.66 to 5.25; eye 2.6 to 3; snout 3.2 to 3.4; D. iv to vi, i, 8 to 10, mostly v–i, 9; A. i, 14 to 16, mostly i, 16; scales 38 to 40.

From Anclote Sponge Kraals, Florida: Total length 2.25 to 2.62; head 3.5 to 4; depth 4.75 to 5.25; eye 2.6 to 3; snout 3 to 3.25; D. v to vi–i, 9, mostly v–i, 9; A. i, 14 to 16, mostly 15; scales 38 to 41.

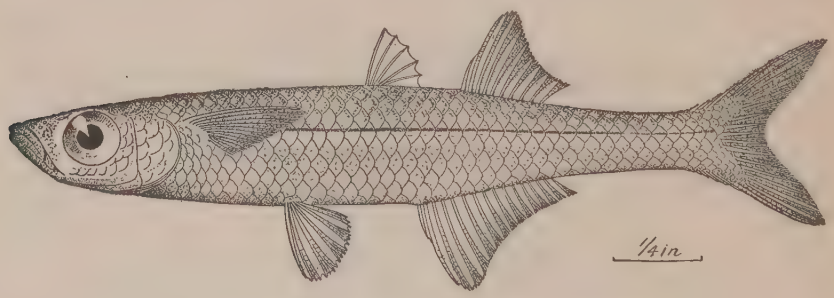
From Titusville: Total length 1.25 to 3.25; head 4 to 4.25; depth 4.75 to 5, mostly 5; eye 2.75 to 3, mostly 3; snout 3 to 3.25, mostly 3; D. iv to vi–i, 9 to 10, mostly v–i, 9; A. i, 15 to 17, mostly 16; scales 37 to 39.

From Grand Plains Bayou, Mississippi: Total length 2 to 3.75 inches; head 4 to 4.5; depth 5.25 to 6; eye 2.6 to 3; snout 3 to 3.5; D. iv to v–i, 9 to 10; A. i, 16 to 17, mostly i, 17; scales 37 to 41.

Menidia peninsulæ atrimentis, new subspecies.

Attention was first attracted to this form by a specimen from South Lake, near Indian River, having a peculiar *Labidesthes*-like appearance—long snout and slender form—but lacking the small scales of *Labidesthes*. Examination of all available specimens of *Menidia* from southern waters revealed similar examples, though not all so slender, from a number of localities in Florida. First, those from Lake Monroe which Goode & Bean included with *M. peninsulæ;* from Lake Jessup, collected by R. E. Earll; then specimens from South Lake at Titusville, Fla., collected by Evermann & Bean; "Salt Lake," near Tarpon Springs, Fla., collected by Evermann & Kendall, and from St. Johns River at Palatka, and from Lake Monroe, collected by the writer.

Total length 2.5 inches; head in length to base of caudal fin 4; depth in same length 6; eye 2.88 in head; snout 3+ in head. D. v–i, 9; A. i, 15; scales 40–8. Very slender; lower jaw longer than eye; spinous dorsal wholly anterior to origin of anal, midway between tip of snout and base of caudal; base of anal much shorter than head, 5 in length of body, equal to distance from base of last rays of soft dorsal to base of upper rudimentary rays of caudal; height of soft dorsal 1.88 and anal 1.66 in head. Color in spirits, straw; scales of back thickly punctated with black on edges, giving the back a very dusky appearance; few black dots on the sides, not defining the edges of the scales; top of head, snout, and chin black, the black composed of fine dots. Lateral silver stripe overlying black.



Menidia peninsulæ atrimentis Kendall, new subspecies.

This fish is much more slender than *M. peninsulæ*, its nearest relative in southern waters; darker in color and found in waters more nearly fresh. It may be distinguished by its slender form, really longer head and larger eyes, although the measurements of specimens of this species often show the same relative proportions, owing to the fact that many of the *M. peninsulæ* are young and these are more slender than the adults. There is considerable variation, and it seems to intergrade with *M. peninsulæ*, but has not been found to attain so large an adult size as the latter. It seems to be confined to fresh or nearly fresh water. The type (No. 50010, U. S. National Museum) is one of 33 specimens collected by Evermann & Bean in South Lake, Titusville, Florida, January 15, 1896.

(*ater*, black; *mentum*, chin.)

Specimens from South Lake range in measurements as follows: Head 4 to 4.33, mostly 4; depth 5.66 to 6.25; eye 2.89 to 3.25, mostly 3; snout 3; D. v–i, 9 and 10; A. i, 16 to 18; scales 40 to 43.

From Lake Monroe as follows: Head 4+ to 4.5; depth 5.5 to 7; eye 3; snout about 3; D. iv to vi–i, 9 to 11; A. i, 16 to 18, mostly 17; scales 38 to 42. From Palatka, not essentially different from Lake Monroe specimens.

From Salt Lake, near Lake Butler, Tarpon Springs, Florida, as follows: Head 3.8 to 4, mostly 4; depth 5.25 to 6; eye 2.6 to 3, mostly 3; snout 3 to 3.25, mostly 3; D. iv to vi–i, 8 to 10; A. 14 to 19; scales 36 to 40.

Menidia audens Hay.

Menidia audens Hay, Bulletin U. S. Fish Commission, 1882, 64; Jordan & Gilbert, Synopsis, 908, 1883; Jordan & Evermann, Fishes of North and Middle America, 798, 1896.

Found in the fresh waters of Mississippi and Tennessee, and differs from *peninsulæ* only in its more slender form. The types are small, all but one being young fish.

Length 3 inches; head 4.5; depth 6; eye 2; snout 3+; D. IV–i, 9; A. i, 17; scales 40–9. Anal base equal to or slightly larger than head; height of first rays of anal equal to height of first rays of soft dorsal, about 1.25 in head.

Specimens range in measurements as follows: total length 1.5 to 3 inches; head 4 to 4.5; depth 6 to 6+; eye 2.33 to 3; snout 3+ to 3.5; D. IV to V–i, 9 to 10; A. i, 17 to 19, mostly 19; scales 39 to 42–9 to 10.

Comparative table of average measurements.

No. of specimens.	Name and locality.	Total length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.
	M. peninsulæ.								
10	Grand Plains Bayou, Miss	2.53	4.16	5.56	2.76	3.28	IV–i, 9	i,16	38
7	Pensacola, Fla	2.03	4.15	5.05	3.02	3.02	VI–i, 9	i,16	39
10	Anclote, Fla	2.53	3.75	4.98	2.91	3.17	V–i, 9	i,15	39
10	Tarpon Springs, Fla	2.53	3.58	5	3.35	3.22	V–i, 9	i,15	39
4	Wechawatchee, Fla	3.03	4	5.18	3+	3+	V–i, 8	i,16	39
10	Titusville, Fla	2.22	4.14	4.93	2.95	3.25	V–i, 9	i,16	38
	General average of 50 specimens.	2.56	3.95	5.10	3	3.18	V–i, 9	i,16	39
	M. peninsulæ atrimentis.								
10	Lake Monroe, Fla	1.80	4.31	5.90	3+	3	V–i,10	i,17	39
3	St. Johns River, Palatka, Fla	2.16	4.19	6.19	3+	3	V–i,10	i,17	40
10	South Lake, Titusville, Fla	2.53	4.07	5.71	3+	3	V–i, 9	i,16	38
7	Salt Lake, near Tarpon, Fla	1.90	4	5.44	2.97	3.64	V–i, 9	i,16	38
	General average of 30 specimens.	2.09	4.27	5.86	3–	3+	V–i, 9	i,17	39
	M. audens.								
5	Vicksburg, Miss	1.82	4.25	6+	2.76	3.16	IV–i,10	i,19	40
1	Memphis, Tenn	2	4.16	6	3+	3+	IV–i,10	i,19	41
1	Edwards, Miss	1.50	4	6	3.60	3+	V–i, 9	i,19	40
	General average of 7 specimens.	1.80	4.20	6	2.77	3.11	IV–i,10	i,18	40

Menidia beryllina (Cope).

Chirostoma beryllinum Cope, Transactions American Philosoph. Society, 1866, 403.

Menidia beryllina, Jordan & Gilbert, Synopsis, 408, 1883; H. M. Smith, Bulletin U. S. Fish Commission, 1890, 70, pl. XX, fig. 2.

Menidia gracilis, Jordan & Evermann, Check-list, 331, 1896, and Fishes of North and Middle America, 797, 1896.

Menidia gracilis beryllina, Jordan & Evermann, Check-list, 331, 1896; Fishes of North and Middle America, 797, 1896.

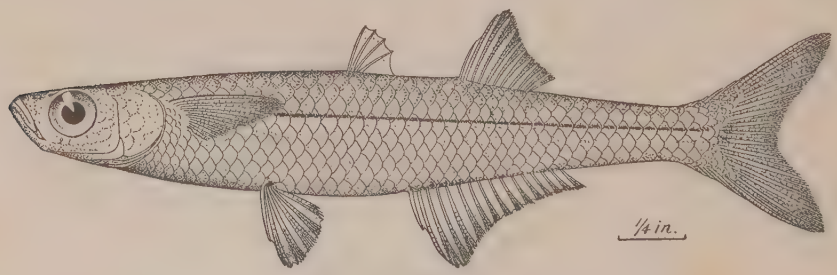
This species was first described by Cope from the Potomac River near Washington in 1866; but strangely enough there are no subsequent records of its having been taken in that neighborhood until H. M. Smith, in 1890, mentions having taken it near Washington, and that it occurs in large numbers in the Lower Potomac; it is recorded in 1891 by the same writer from Pasquotank River and Edenton Bay, North Carolina; then in 1894 by Kendall & Smith from Woods Hole and New Bedford, Mass., and it is mentioned in the same paper as being common at Washing-

ton. In 1897 the writer collected many specimens in the Potomac near Washington. Bean records its capture at Watermill, Long Island.

In Fishes of North and Middle America, Jordan & Evermann, without having examined and compared many specimens, assign the Lower Potomac, Albemarle region, and Woods Hole forms to Günther's *Menidia gracilis*, and leave the Upper Potomac form for Cope's *M. beryllina*, representing that fish from the fresh waters of the Potomac are deeper bodied.

From an examination of a large number of specimens from the localities mentioned, it is found that they seem to intergrade. Specimens from Truro, Falmouth, Woods Hole, New Bedford, Long Island, Chesapeake Bay, Albemarle Sound, Mattamuskeet Lake, North Carolina, and Sampit River, South Carolina, seem to run smaller and of a different general appearance from the typical Potomac fish, possessing sufficient differences to entitle them to a subspecific name. Specimens from St. Georges Island, Lower Potomac, as a rule are rather more slender than those from about Washington, otherwise they do not differ, except in average smaller size. The small size accounts for the slenderness, for small individuals from the vicinity of Washington are just as slender.

Assuming that the numerous specimens collected in the Potomac River in the vicinity of Washington are Cope's *Menidia beryllina*, with the description of which they agree very well, our studies compel us to assign the form called *M. gracilis* to this species. This seems especially justifiable, since the difference is only one of size,



Menidia beryllina (Cope).

and that so slight that it is hardly of subspecific value; furthermore, Günther's *M. gracilis* is *sine patria* and his description does not fit this form better than it does the others. This arrangement will restrict the name *M. beryllina* to the Potomac River form.

Redescription of Menidia beryllina.

Length 3 inches; head 4.5; depth 5.50; eye 2.8; snout nearly 4; D. iv–i, 10; A. i, 15; scales 39–9. Lower jaw equal to snout; spinous dorsal entirely in advance of origin of anal, midway between tip of snout and base of upper rudimentary rays of caudal; base of anal longer than head; its height in front greater than height of front of soft dorsal, 1.4 in head; height of soft dorsal 1.75. Color in spirits, straw; sides of head silvery; scales of back edged with dark dots; faint dark dots on rays of soft dorsal; dusky streak at base of anal; lateral silvery stripe overlying black. Specimen from the Potomac River, Washington, D. C., June, 1897, collected by Kendall. (U. S. National Museum No. 50012.)

Specimens from Washington present the following range of measurements: Total length 2.37 to 3 inches; head 4.4 to 4.5; depth 4.83 to 5.33; eye 2.6 to 3; snout 3.25 to 3.5; D. iv to v–i, 9 to 10, mostly iv–i, 10; A. i, 16 to 18; scales 36 to 41.

From Lower Potomac: Total length 2.5 to 2.62 inches; head 4 to 4.5; depth 5.5 to 6; eye 3 to 3+; D. v–i, 9 to 11, mostly v–i, 10; A. i, 15 to 18; scales 38 to 40.

Menidia beryllina cerea, new subspecies.

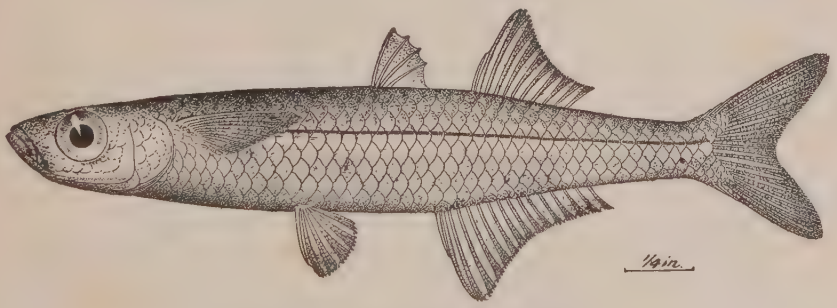
Menidia beryllina, H. M. Smith, Bulletin U. S. Fish Commission, 1891, 192 and 195; Kendall & Smith, Bull. U. S. Fish Commission, 1894, 21; Bean, Bulletin American Museum of Natural History, IX, 1897, 357; Bean, Annual Report New York State Museum, 1900, 102.

Menidia gracilis, (in part) Jordan & Evermann, Check-list, 351, 1896, and Fishes of North and Middle America, 797, 1896.

As previously mentioned, a small *Menidia*, abundant at Woods Hole during the summer months, has hitherto been considered *M. beryllina* or *M. gracilis*. A great many specimens have been examined, and there seems to be considerable variation, some specimens being markedly different from *M. beryllina*, others resembling it more closely. The relative measurements as usually taken do not show differences so much as similarities, so it will be necessary to state that most of those from Woods Hole seem to be much unlike *M. beryllina*, while those from Falmouth have a general resemblance but are considerably smaller.

The New Bedford fish are mostly like those from Woods Hole, but larger specimens were obtained there which are hard to distinguish from the *M. beryllina* from St. Georges Island, Lower Potomac.

Dr. Bean, having examined some of our specimens from Woods Hole, concurs in the opinion that they are the same species as those taken by him at Long Island in fresh water, notwithstanding the fact that many of the Woods Hole specimens were found in salt water and that the original *beryllina* is a fresh-water fish.



Menidia beryllina cerea Kendall, new subspecies.

A specimen from Cape Charles City, Va., seems to be much like the New Bedford fish just mentioned, but bears also resemblance to the Lower Potomac fish. The *M. beryllina*-like forms found farther south appear to be like this specimen. They are intermediate in appearance between the Potomac *M. beryllina* and Woods Hole *M. beryllina cerea*. This arrangement is not the conventional idea of intergradation, but inasmuch as this Woods Hole form is so different from *M. beryllina* as to require some distinguishing designation, it seems that the best that can be done with it is to consider it a subspecies.

This arrangement, then, will include specimens from Truro, Sandwich, Falmouth, Woods Hole, Wareham, and New Bedford, Mass., and Long Island, New York, Cape Charles City, Va., Albemarle Sound and Mattamuskeet Lake, North Carolina, and Sampit River, South Carolina.

Total length 2.37 inches; head 4.14; depth 5.8; eye 2.8; snout 3.5; D. IV–I, 10; A. I, 15; scales 39. Smaller adult size than in *M. beryllina*, less compressed laterally; head bluntly conic; profile from front of eyes to tip of snout more rounded than in *M. beryllina*, outline of muzzle less truncate, and caudal peduncle usually shorter; lateral stripe narrow, occupying fourth row of scales, counting from front of dorsal fin. Color, waxy translucent, thickly punctated with black on top of head and back; dots on edges of scales excepting those of throat; snout and chin black from concentration of dots.

(*Cereus*, waxen.)

U. S. National Museum No. 50011. Collected by B. A. Bean at Waquoit Bay, Mass.

Specimens from Falmouth present the following range of measurements: Total length 1.5 to 2.5 inches; head 4 to 4.83; depth 4.5 to 6; eye 2.75 to 3.25; snout 3 to 4; D. IV to VI–i, 9 to 11, mostly v–i, 9 or 10; A. i, 15 to 18; scales 37 to 40.

From Woods Hole: Total length 1.87 to 2.25 inches; head 4 to 4.25; depth 4.6 to 6; eye 3— to 3+; snout 3 to 3.4; D. IV to VI–i, 9 to 10, mostly v–i, 9; A. i, 15 to 20; scales 38 to 41.

From Wareham River: Total length 1.37 to 1.62; head 3.6 to 4; depth 4.75 to 5.75; eye 2.6 to 3; snout 3+ to 3.5; D. IV to v–i, 9 to 10; A. I, 15 to 17; scales 37 to 40.

From Watermill, Long Island: Total length 2 to 2.93 inches; head 4.1 to 4.5; depth 5.44 to 6; eye 2.75 to 3.33; snout 3.14 to 3.33; D. v–i, 9 and 10; A. I, 17 and 18; scales 39 to 41.

From Albemarle Sound: Total length 1.87 inches; head 4.2 to 4.5; depth 6 to 6.33; eye 2.5 to 2.66; D. IV to VI–i, 9 to 11; A. I, 17 to 18; scales 40 to 42.

From Sampit River, South Carolina: Total length 2.12 to 2.87; head 4.16 to 4.75; depth 5.75 to 6.33; eye 2.5 to 3+; snout 3 to 3+; D. IV to VI–i, 9 to 11; A. I, 17 to 19; scales 37 to 40.

Comparative table of average measurements of Menidia beryllina and Menidia beryllina cerea.

No. of specimens.	Name and locality.	Total length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.
	M. beryllina.	*Inch.*							
10	Potomac River, Washington	2.84	4.50	5.07	2.86	3.44	v–i, 10	i, 17	38
10	Potomac River, St. Georges Island	2.53	4.20	5.90	3	(?)	v–i, 10	i, 17	(?)
	General average of 20 specimens	2.83	4.30	5.63	2.93	3.44	v–i, 10	i, 17	39
	M. beryllina cerea.								
10	Falmouth, Mass	2.09	4.16	5.34	3	3.27	v–i, 10	i, 16	37
10	Woods Hole, Mass	2.07	4.14	5.17	3	3.09	v–i, 9	i, 16	39
10	Wareham River, Mass	1.60	3.43	5.12	2.87	3.28	v–i, 9	i, 16	37
	Watermill, Long Island	2.08	4.26	5.72	3	3.26	v–i, 10	i, 17	40
5	Albemarle Sound, Edenton, N. C	1.85	4.28	6.20	2.60	.....	v–i, 10	i, 17	40
1	Lake Mattamuskeet, N. C	2.87	4.33	6	3.25	.....	v–i, 11	i, 18	39
8	Sampit River, Georgetown, S. C	2.39	4.44	6	2.81	3	v–i, 10	i, 17	37
	General average of 44 specimens	2.05	4.20	5.64	2.96	3.24	v–i, 9.5	i, 16	39

Menidia menidia and Menidia notata.

Examination of the types of *Menidia dentex* Goode & Bean from St. Johns River, Florida, and of specimens from Charleston, S. C., the type locality of *Atherina menidia* Linnæus, led to examination and comparison of specimens of *Menidia menidia* and *Menidia notata* from other localities ranging northward as far as Halifax, Nova Scotia, resulting in the discovery of the intergradation of the species of *M. notata* and *M. menidia*. Since *M. menidia* Linnæus (1766) has priority, the form called *M. notata* (Mitchill) must stand as *Menidia menidia notata* (Mitchill).

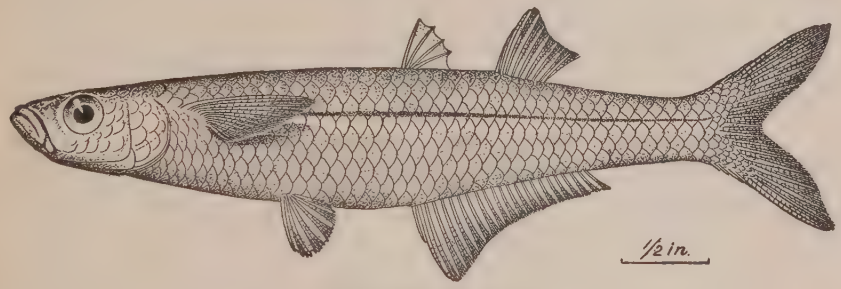
Beginning with the St. Johns River, *C. dentex* agrees most nearly with the description of *M. menidia;* northward the intergradation becomes more and more evident, reaching its height in the Chesapeake region, whence northward the characters

approach typical *M. notata*, agreeing perfectly in nearly all specimens north of Cape Cod.

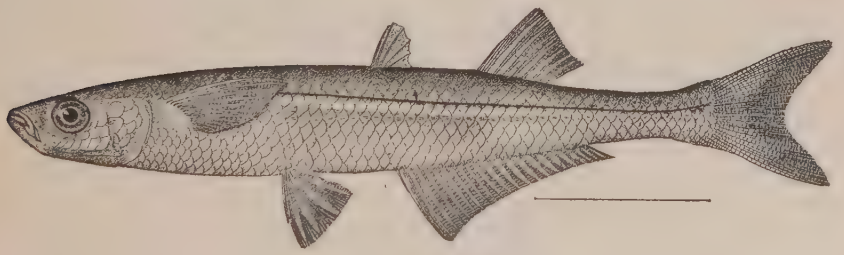
The differential characters heretofore considered specific were the more backward situation of the first dorsal, fewer scales in longitudinal and cross series, and the deeper body of *M. menidia*. From the accompanying comparative tables it will be seen that the scales increase in number, the first dorsal moves forward, and the body becomes more slender in many specimens from the successive northward localities.

In Chesapeake Bay the differential characters do not conform to the specific requirements; thus individuals with the backward position of the first dorsal have the slender bodies and more numerous scales of *M. notata* and vice versa. With specimens from Woods Hole agreeing perfectly with *M. notata*, mixed forms as well as perfect *M. menidia* are found, the majority being the *M. notata* form.

The range of *Menidia menidia*, as given by Jordan & Evermann in Fishes of North and Middle America, is from Cape Hatteras to Florida. Curiously, the range of *M.*



Menidia menidia (Linnæus).



Menidia menidia notata (Mitchill).

notata, in the same work, is given south to Cape May, leaving an intervening space of many miles—Cape May to Hatteras—seemingly unoccupied by either form, but which is inhabited by the intergrading or mixed forms of *M. menidia* and *M. notata*.

The comparative tables appended represent localities covering the coast pretty fairly from St. Johns River, Florida, to Gloucester, Mass.; at least representative localities are shown sufficiently indicating the intergradation of the two forms. The intergradation, however, is not uniform. As has been said, and as may be seen from the tables, specimens have been taken in the Chesapeake which conform respectively to the descriptions of *M. menidia* and *M. notata*; at the same time others do not agree with the description of either, or rather partake of the characters of both forms to such an extent that it is impossible to say to which form it belongs. Specimens have been found at Wood Hole, even, which are essentially the *M. menidia* form. This is hardly an ideal intergradation, rather such as might be expected from the interbreeding of two closely related species and the occurrence of stragglers of either of the two forms or their hybrid offspring north or south of the point of the intermingling.

Menidia menidia (Linnæus).

Atherina menidia Linnæus, Systema Naturæ, vol. 1, ed. XII, 519, 1766, Charleston, S. C.; Lacépède, Histoire Naturelle Poissons, vol. v, 371.
Atherina boscii Cuvier & Valenciennes, Histoire Naturelle Poissons, X, 465, 1835.
Menidia dentex Goode & Bean, Proceedings U. S. National Museum, 1882, 429.
Menidia brasiliensis, Jordan & Gilbert, Synopsis, 408, 1883; not of authors.
Menidia menidia, Jordan & Evermann, Fishes of North and Middle America, I, 800, 1896.

Head 4.66; depth 5; eye 3.25; snout 3.25; D. IV–i, 8; A. i, 22; scales 41–7. Mouth rather large; eye about equals snout; anal base .16 longer than head; origin of first dorsal nearer base of caudal fin than tip of snout. Color, light olivaceous; minute brown punctulations on the jaws, top of head, and around the posterior margin of the scales on the back. Silvery band along side about two-thirds the width of a scale of the series through which it runs. (Description taken from one of the types of *M. dentex*, 4.37 inches long, U. S. National Museum No. 18051.)

From St. Johns River types and cotypes of *M. dentex* range in measurements as follows: Total length 2.75 to 4.37 inches; head 4.25 to 4 66; depth 4.33 to 5.25; eye 3.33; snout 3+ to 3.33; D. IV to VI-i, 7 to 8; A. i, 20 to 24; scales 39 to 41–7 to 8.

Menidia menidia notata (Mitchill).

Atherina notata Mitchill, Trans. Literary and Philo. Society New York, I, 1815, 446, New York.
Atherina viridescens Mitchill, Literary and Philosophical Society of New York, I, 1815, 447, New York.
Atherinichthys menidia and *notata*, Günther, Cat., III, 406, 1861.
Menidia notata, Jordan & Gilbert, Synopsis, 407, 1883; H. M. Smith, Bulletin U. S. Fish Commission 1890, 690; Jordan & Evermann, Fishes of North and Middle America, I, 800, 1896.

Total length 5.75 inches; head 4.66; depth about 6.66; eye 3.85; snout 3; dorsal v-i, 10; anal i, 23; scales 45–10. Pectoral about .16, and anal base about .2 longer than head; first dorsal fin midway between tip of snout and base of caudal. Color, back translucent greenish; scales above lateral silver band thickly punctated with dark brown on the edges; top of head, nose, and chin dusky; iris and cheeks silvery; lateral silver band from behind upper part of pectoral to base of caudal, passing through the fifth scale of oblique series below front of first dorsal, occupying the lower two-thirds of the scale; silvery band, bordered above by narrow black streak; spines and rays of all but the ventral fins with fine dark-brown dots; few dots of brown on edges of scales on side below silver band; belly white. (Description from a specimen from Woods Hole, Mass., V. N. Edwards, collector, November 13, 1900.)

*Comparative tables of measurements of Menidia menidia and Menidia menidia notata.**

[Mouth of St. Johns River, Florida.†]

Length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.	Length of anal base compared with head.	Position of first dorsal.
Inch.									
4.37	4.66	5	3.25	3.25	IV–i, 8	i, 22	41–7	.16 longer than head.	Nearer caudal than snout.
4.37	4.60	4.60	3.33	3.33	IV–i, 7	i, 21	39–8	.20 longer than head.	Do.
3	4.25	5.25	3.20	3.20	IV–i, 8	i, 24	40–8	About .20 longer....	Nearer caudal.
3	4.33	4.33	3+	3+	V–i, 7	i, 20	41–8	.....do	Do.
2.75	4.33	4.60	3+	3+	V–i, 8	i, 25	41–8	.....do	Do.
2.75	4.50	5	3+	3+	IV–i, 7	i, 23	40–8	.....do	Do.

*No attempt has been made to separate the two forms except by locality.
†The specimens recorded from mouth of St. Johns River, Florida, are in the United States National Museum as types and cotypes of *Menidia dentex* Goode & Bean.

Measurements of Menidia menidia and Menidia menidia notata—Continued.

[Tybee Roads, Georgia, W. C. Kendall, collector.]

Length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.	Position of first dorsal.
Inch.								
3	4.50	6	2.60	3—	IV–i, 7	i, 21	39–6	Considerably nearer caudal than snout.
3.37	4.25	5.60	3+	3	IV–i, 7	i, 21	42–8	Somewhat nearer caudal.
3.37	4.66	5.80	3.20	3.20	IV–i, 7	i, 21	41–8	Much nearer caudal.
3.50	4.20	6	3+	3+	VI–i, 8	i, 22	39–7	Considerably nearer caudal.
3.50	4.25	5.50	3.25	2.83	IV–i, 7	i, 22	41–8	Some nearer caudal.
3.25	4.25	6—	3+	3+	IV–i, 8	i, 23	41–7	Slightly nearer caudal.
2.75	4.33	5.25	3	3	IV–i, 8	i, 21	39–8	Do.
3	4.25	5.50	3+	3+	IV–i, 8	i, 23	42–8	Considerably nearer caudal.
3.12	4	5.83	3+	3+	IV–i, 8	i, 23	41–8	Do.

[Scull Creek, South Carolina, W. C. Kendall, collector.]

3	.....	6	.....	.....	.....	i, 22	39–7	Considerably nearer caudal.
3.75	.....	5.60	.....	.....	.....	i, 22	41–8	Do.
3.12	.....	5.80	.....	.....	.....	i, 22	39–8	Do.
3.25	.....	5.40	.....	.....	.....	i, 22	41–8	Nearer caudal.
3.50	.....	6.50	.....	.....	.....	i, 22	40–8	Considerably nearer caudal.
3.37	.....	5.66	.....	.....	.....	i, 25	40–8	Do.
3.25	.....	5.75	.....	.....	.....	i, 22	40–8	Do.
3.37	.....	5.50	.....	.....	.....	i, 21	38–8	Slightly nearer.
3.25	.....	5.50	.....	.....	.....	i, 22	39–8	Considerably nearer.
3.37	.....	5.66	.....	.....	.....	i, 21	40–8	Slightly nearer.

[Charleston, South Carolina, R. E. Earll, collector.]

3.75	4.33	5.33	3.40	3.40	V–i, 8	i, 24	43–8	Nearer caudal.
4	4.50	5	3.33	3.33	IV–i, 8	i, 21	42–8	Do.
3.87	4.33	4.83	3.60	3.60	IV–i, 7	i, 23	42–8	Do.
3.50	4.50	5	3.25	3.25	V–i, 7	i, 24	41–8	Do.
3.25	4.25	5	3+	3+	V–i, 7	i, 21	42–8	Do.
3.56	4.40	5.50	3.20	3.20	IV–i, 8	i, 23	42–7	Do.

[Winyah Bay, South Carolina, W. C. Kendall, collector.]

3	.....	6.33	.....	.....	.....	i, 23	42–8	Nearer caudal.
3	.....	6.16	.....	.....	.....	i, 22	40–7	Slightly nearer caudal.

[Fort Macon, N. C., W. C. Kendall, collector.]

4.75	5	5+	3.20	3.20	V–i, 9	i, 23	44–8	Midway between tip of snout and base of caudal.
4.25	5	5.83	3.20	3.20	IV–i, 8	i, 22	45–8	Do.
4.75	4.80	4.50	3.20	3.20	IV–i, 9	i, 24	45–9	Slightly nearer tip of snout.
4.25	5	5+	3.25	3.25	V–i, 9	i, 24	45–8	Midway between tip of snout and base of caudal.
4.25	5	5.25	3.25	3+	V–i, 7	i, 21	45–8	Do.
4.12	4.80	4.80	3.20	3.20	IV–i, 8	i, 25	41–8	Do.
3.87	5	5	3.16	3—	IV–i, 9	i, 23	43–8	Slightly nearer base of caudal.
4.25	4.66	4.66	3.25	3.25	V–i, 8	i, 22	44–9	Midway between tip of snout and base of caudal.
3.87	.....	6—	.....	.....	.....	i, 26	42–8	Slightly nearer caudal.
3.50	.....	5.16	.....	.....	.....	i, 23	42–8	Do.
3.50	.....	4.66	.....	.....	.....	i, 25	43–8	Do.
3.62	.....	5.75	.....	.....	.....	i, 22	43–8	Considerably nearer caudal.
3	.....	5.60	.....	.....	.....	i, 22	42–7	Do.
3.37	.....	5.80	.....	.....	.....	i, 21	42–8	Do.
3	.....	5.60	.....	.....	.....	i, 22	40–7	Midway between tip of snout and base of caudal.
3.25	.....	5.57	.....	.....	.....	i, 23	40–8	Considerably nearer caudal.
3.62	.....	5.25	.....	.....	.....	i, 22	41–8	Do.
3.75	.....	5.25	.....	.....	.....	i, 24	42–8	Slightly nearer caudal.

[Wilmington, N. C. (U. S. National Museum).]

3.62	3.50	5.40	3.33	3.33	V–i, 9	i, 22	40–8	Nearer caudal.

Measurements of Menidia menidia and Menidia menidia notata—Continued.

[Fortress Monroe, Va., W. C. Kendall, collector.]

Length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.	Position of first dorsal.
Inch.								
3.75	4.50	5.60	3.25	3.25	v-i, 7	i,24	45-9	Considerably nearer base of caudal.
3.75	4.50	5.50	3.20	3.25	v-i, 8	i,20	45-8	Do.
4	4.50	5.60	3.25	3.2	iv-i,10	i,26	46-8	Do.
4.50	5.20	6	3.25	3.25	iv-i, 9	i,27	46-9	Midway between tip of snout and base of caudal.
3.25	4.50	5.33	3.25	3.25	iv-i, 9	i,21	46-8	Do.
2.25	4+	5.20	3	3.25	iv-i, 9	i,24	42-8	Nearer caudal.
2	4.25	5.25	3	3	v-i, 9	i,22	44-8	Midway between tip of snout and base of caudal.

[Mouth of Rappahannock River, Virginia, W. C. Kendall, collector.]

2.50	4.33	5	3.25	3.25	iv-i,9	i,21	43-10	Midway between tip of snout and base of caudal.

[Cape Charles City, Va., W. C. Kendall, collector.]

3.75	4.25	5.25	3.25	3.25	iv-i,8	i,22	44-8	Midway between tip of snout and base of caudal.
2.50	4.25	4.60	2.83	3.25	v-i,8	i,23	42-8	Do.
2.25	4.16	5	3	3.25	iv-i,9	i,24	42-8	Slightly nearer caudal.

[Woods Hole, Mass., V. N. Edwards, collector.]

4.75	4.60	6+	3.20	3.20	v-i, 9	i,22	48-10	Midway between tip of snout and base of caudal.
4	5	6	3.20	3.20	iv-i, 8	i,23	46-10	Do.
3.50	4.60	5.50	3.33	3.33	v-i, 8	i,23	45- 8	Do.
3.81	4.75	6.25	3.60	3.60	v-i, 9	i,23	47-10	Somewhat nearer caudal.
4	4.50	7.08	3.80	2.71	v-i, 9	i,25	48-10	Somewhat nearer snout.
3.74	4.44	6.66	3.60	3	v-i, 9	i,23	45-10	Somewhat nearer caudal.
3.62	4.60	6.50	3.40	3	v-i,10	i,24	47-10	Midway between tip of snout and base of caudal.
4.06	4.60	6.75	3.80	3.16	iv-i, 9	i,23	43- 9	Do.
4	4.66	6.07	3.60	3	iv-i, 9	i,23	43- 9	Do.
4.25	4.75	7	3.80	3.16	iv-i, 9	i,27	48- 9	Considerably nearer caudal.
4.81	5	6.20	3.50	3	iv-i, 8	i,23	46- 8	Considerably nearer tip of snout.
5.25	4.50	4.75	4.16	2.66	v-i, 9	i,24	45- 9	Somewhat nearer caudal.
4.87	4.50	6.75	4	3	iv-i,10	i,23	46-10	Slightly nearer tip of snout than caudal.
5.06	4.62	6.50	3.50	3	v-i, 9	i,25	48-10	Midway between tip of snout and base of caudal.
5.12	4.75	6.11	3.28	2.87	v-i,10	i,22	44- 9	Do.
5.25	4.60	6.75	4.16	3.12	v-i,10	i,24	45- 9	Do.
5.25	4.50	6.71	3.57	3.12	v-i, 9	i,25	49- 9	Do.
5.37	4.87	5.95	4.16	3.12	v-i, 9	i,24	46- 9	Do.
5.25	4.60	6.33	4.16	3.12	vi-i, 9	i,24	47-10	Do.
5.75	4.71	6.75	3.86	3	v-i,10	i,23	49-10	Somewhat nearer caudal.

[Gloucester, Mass., W. C. Kendall, collector.]

3.12	4.75	6.20	3+	3+	v-i, 9	i,27	46-10	Midway between tip of snout and base of caudal.
3	4.75	6.25	3.20	3.20	v-i, 8	i,23	46- 9	Do.
2.37	4.50	6	3	3	v-i, 9	i,25	46- 9	Slightly nearer tip of snout.
2.75	4.33	5.75	3.20	3.20	v-i,10	i,27	45- 9	Do.
2.50	4.33	6.20	3	3	v-i,10	i,25	43- 9	Do.
3.25	4.50	6+	3.25	3.25	v-i, 9	i,27	49-12	
2.87	4.60	6.75	3.16	3.16	v-i, 8	i,23	49- 9	
2.12	4.60	6.50	3+	3+	v-i,10	i,29	47-10	
2	4.40	6.20	3.20	3.20	v-i, 9	i,26	43- 9	
2.50	4.50	6+	3.20	3.20	v-i, 8	i,25	40- 9	
2.25	4.50	6+	3+	3+	v-i, 9	i,23	43- 9	
2.50	4.40	5.75	3+	3+	v-i, 9	i,26	48- 9	
2.37	4.40	7+	3+	3+	v-i,10	i,27	48- 9	
2.37	4.60	7.50	3+	3+	iv-i,11	i,25	48- 9	

Comparative table of average measurements of Menidia menidia and M. menidia notata.

No. of specimens.	Locality.	Total length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.
		Inch.							
7	Mouth of St. Johns River, Fla	3.37	4.47	4.75	3.13	3.13	IV–I, 8	I, 22	40–8
9	Tybee Roads, Ga.....	3.20	4.27	5.72	3+	3+	IV–I, 8	I, 22	40–8
10	Scull Creek, S. C	3.32	.....	5.80	.....	.....	.....	I, 22	40–8
5	Charleston, S. C.....	3.66	4.38	5.03	3.31	3.31	V–I, 7	I, 22	42–8
2	Winyah Bay, S. C	3	.....	6.25	.....	.....	.....	I, 22	41–8
8	Fort Macon, N. C.*.....	4.81	4.90	5.13	3.21	3.16	V–I, 8	I, 23	44–8
11	Chesapeake Bay*.....	3.03	4.40	5.27	3.20	3.22	IV–I, 8	I, 23	44–8
20	Woods Hole, Mass., and vicinity*..	4.21	4.69	6.36	3.67	3.06	V–I, 9	I, 23	45–9
14	Gloucester, Mass.....	2.72	4.50	6.39	3.09	3.09	V–I, 9	I, 25	46–9

*Mixed characters.

From St. Johns River, specimens present the following measurements: Total length 2.75 to 4.37 inches; head 4.25 to 4.66; depth 4.33 to 5.25; eye 3.33; snout 3+ to 3.33; D. IV to VI–I, 7 to 8; A. I, 20 to 24; scales 39 to 41–7 to 8.

From Tybee Roads, Ga.: Total length 2.75 to 3.75 inches; head 4 to 4.66; depth 5.25 to 6; eye 2.6 to 3.2; snout 2.83 to 3.2; D. IV to VI–I, 7 to 8; A. I, 21 to 23; scales 39 to 42–6 to 8.

From Scull Creek, S. C.: Total length 3 to 3.75 inches; depth 5.5 to 6; A. I, 21 to 22; scales 38 to 41.

From Charleston, S. C.: Total length 3.25 to 4 inches; head 4.25 to 4.5; depth 4.83 to 5.33; eye 3+ to 3.6; snout 3+ to 3.6; D. IV to V–I, 7 to 8; A. I, 21 to 24; scales 41 to 43–8.

From Fort Macon, N. C.: Total length 4.66 to 5 inches; head 4.66 to 5; depth 4.66 to 6—; eye 3.16 to 3.25; snout 3—to 3.25; D. IV to V–I, 7 to 9; A. I, 21 to 26; scales 40 to 45–7 to 9.

From Chesapeake Bay: Total length 2 to 4.5 inches; head 4+ to 5.2; depth 5 to 6; eye 2.83 to 3.25; snout 3 to 3.25; D. IV to V–I, 8 to 10; A. I, 20 to 27; scales 42 to 46–8 to 10.

Woods Hole and vicinity: Total length 2.5 to 5.75 inches; head 4.44 to 5; depth 5.5 to 7; eye 3.2 to 4.16; snout 2.8 to 3.33; D. IV to VI–I, 8 to 10; A. I, 22 to 25; scales 43 to 49–8 to 10.

From Gloucester, Mass.: Total length 2 to 3.25 inches; head 4.33 to 4.75; depth 5.75 to 7.5; eye 3 to 3.25; snout 3 to 3.25; D. IV to V–I, 8 to 11; A. I, 23 to 27; scales 43 to 49–9 to 12.

NOTE ON THE SCOTCH METHODS OF SMOKING HADDOCKS.

By Hugh M. Smith.

The haddock (*Melanogrammus aeglifinus*) is one of the most important fishes of Scotland. It represents nearly one-fourth the value of the entire fish production (excluding shellfish), and is outranked by no other species except the herring (*Clupea harengus*). In 1900 the haddock catch amounted to upward of 76,000,000 pounds, worth £502,660, or about $2,513,000. Aberdeen is the leading center of the haddock fishery. The quantity taken there in the year named was nearly 48,000,000 pounds, which was two-thirds the output of Scotland and exceeded by several million pounds the aggregate catch of haddock in the United States in 1898. Both lines and beam trawls are used in the haddock fishery, but the latter are by far the more important means of capture.

Haddock are landed on the Scotch coasts in a fresh state, and are then variously prepared for consumption. A favorite mode of treatment is smoking, and the principal place where smoking is done is Aberdeen, where the writer spent a short time in examining the methods of the haddock trade in the fall of 1900.

The fish smoked in the largest quantities and after the most approved method are known as "findon haddocks." Many changes have been rung on this name in England, Scotland, and America, and many explanations of the name have been offered. This form of prepared fish originated many years ago in the Scotch village of Findon, not far from Aberdeen, when it was an important fishing center. Findon has now no fisheries, but its method of preparing haddocks is known and more or less correctly practiced on most parts of the Scotch coast, as well as in England, the United States, and the Canadian maritime provinces. "Finnan haddies," the usual form in which the name appears in print, is simply the Scotch for "Findon haddocks."

These fish are universally popular; and although liberties have been taken with the method as originally practiced which have not been in the interest of quality, yet they are deservedly considered among the best of all smoked fish, as well as the most palatable of all haddocks.

The essential steps to which haddocks are subjected in course of

preparation as "findon haddocks" are (1) splitting, (2) salting, and (3) smoking, the last being the most important.

The fresh haddock is first treated by removing the head, splitting down the back, eviscerating, and then giving an extra cut behind the backbone from the right-hand side, in order to expose to view and facilitate the curing of the thick muscles of the back. This supplementary cut does not extend to the tail. The fish is then salted for half an hour in strong brine, and after draining is ready for smoking.

The original "findon haddocks" were smoked by hanging them in a chimney, over a peat fire; but at this time none is thus prepared, unless it be for limited home consumption. Peat is still used for producing the heat and smoke, but the primitive chimney has given way to the specially constructed small smokehouse, in which the fish, impaled and spread open on sticks, are hung in tiers. The lowermost row of fish is only 1 to 2 feet above the smudge fire of peat mixed with sawdust, and the smoking is continued without interruption for five to six hours. During smoking the fish require constant attention, in order that the various rows may be smoked thoroughly, uniformly, and not too much. One of the most successful of the Aberdeen curers smokes his fish five hours, then washes them with a brush in clean salt water, in order to remove soot and other foreign matter that would detract from the appearance.

Findons are sent to market either in barrels or boxes. The barrels contain 150 to 160 pounds of fish, and are usually consigned to the commission trade. The best fish are put in boxes holding 40 pounds. They are packed in tiers, with their backs down, with the exception of the top tier. They are sometimes sold in bunches of three tied together by their tails.

Although the canning of "findon haddocks" is a technical paradox and a theoretical absurdity, yet in practice this is done for purposes of export. It is reported that the canned smoked fish keep for several years, but it can be safely asserted that no fish cured as "findon haddocks" should be would keep for that length of time, and unless they are so cured they are not "findons." The excellent canned "findon haddocks," so called, prepared in the United States are thoroughly cooked in addition to being smoked, and often have considerable fluid in the can. It is a misnomer to designate such goods "findons."

Under the name of "smokies" small haddocks prepared in a special way are known to the Scotch trade. They are beheaded, opened along the abdomen and eviscerated, but are not split or spread. After a very short immersion in strong brine they are put on sticks and smoked over a hot fire with plenty of smoke until they have acquired a golden color. The smoking is done in a rectangular stone kiln, open above and with the fire at the bottom, the fish being hung quite close to the fire. A piece of burlap covers the top of the kiln when

the smoking begins. Smokies are somewhat in disrepute because fish of poor or doubtful quality are sometimes so prepared; but when fresh fish are treated in this way they are very palatable. When the fish come from the kiln they are cooked as well as smoked, and are ready for immediate consumption.

Still another method of preparing smoked haddocks is pursued at Aberdeen and doubtless at other places on the north coast of Scotland. The fish are beheaded, split down the abdomen, and spread open by a single cut along the backbone extending out on the caudal peduncle, but there is no supplementary cut back of the vertebræ, as in the findon haddocks. The fish are salted for about twenty minutes in brine that will float a potato, and then very lightly smoked. Such fish are known as "pale smoked haddocks," and are, of course, intended for immediate consumption.

Haddock are prepared as "findons" at a number of places on our east coast. They meet with a ready sale and are justly regarded as among the most delicious of fishery food products. The trade therein should be largely increased at the expense of the trade in haddocks that are too often improperly designated "fresh." The methods of preparing findon haddock and other kinds of smoked haddock are applicable to small cod, hake, pollock, and other gadoid fishes, all of which may be made into wholesome smoked fish. The smoking and light salting to which they would be subjected would overcome the flat taste of such fish when eaten fresh. The smoking of the ground fishes generally would greatly promote the fishing industry in many of the towns of the eastern seaboard by opening new markets, by making possible the utilization of fishes for which there is only limited local demand in the fresh condition, and by preventing gluts which now so often occur.

Following is an instance of the losses resulting to the fishermen through inability to dispose of a large catch through the absence of a market for fresh fish. On May 10, 1901, the traps on the north side of Marthas Vineyard, Mass., were filled with pollock. The fishermen reported that more pollock were caught on that day than in the previous twenty-five years combined. It was estimated that not less than 25,000 fish were in the nets. Four or five thousand were shipped, but the market was flat and the shipments did not pay expenses; the other fish were thrown away. It is reasonably certain that if the fishermen had been provided with facilities for smoking or otherwise curing these fish they could eventually have disposed of them at a fair profit, especially if previous shipments of lightly smoked pollock had prepared the way for the larger catch.

DESCRIPTION

OF A

NEW SPECIES OF SHAD (ALOSA OHIENSIS),

WITH

NOTES ON OTHER FOOD-FISHES OF THE OHIO RIVER.

By BARTON WARREN EVERMANN,
Ichthyologist of the United States Fish Commission.

DESCRIPTION OF A NEW SPECIES OF SHAD (ALOSA OHIENSIS) WITH NOTES ON OTHER FOOD-FISHES OF THE OHIO RIVER.

By Barton Warren Evermann,
Ichthyologist of the United States Fish Commission.

From time to time there have come to the U. S. Fish Commission reports of the capture of shad in the Mississippi basin. When attempts were made to verify these reports, either no reliable data could be secured or the fish thought to be a shad proved to be some other species. For example, the "shad" from the Atchafalaya River, in Louisiana, was shown by the present writer in 1897 to be an undescribed species and genus of the hickory shad family (*Dorosomidæ*) which was named *Signalosa atchafalayæ*. This is a small fish, not exceeding a few inches in length, which is used as bait by the cat-fish fishermen of that river.

As long ago as 1872 Professor Baird called attention to the occurrence of shad in the Ouachita River, in Arkansas, and Dr. Goldsmith, of Vermont, stated that he had several years previously taken shad at the Falls of the Ohio.

The "shad" now and then reported from the Ouachita, White, and St. Francis rivers and other waters in Arkansas proved, in some cases at least, to be the hickory shad, *Dorosoma cepedianum*. Not many of the reports from this region, however, have been investigated. A few years ago the toothed herring or mooneye (*Hiodon alosoides*) became unusually common in the Wabash, and, coming as it did, soon after a plant of Potomac shad had been made in the Wabash by the U. S. Fish Commission upon the recommendation of the late Col. Richard W. Thompson, local fishermen were in the habit of referring to it as the "Dick Thompson shad."

A newspaper item from Montgomery, W. Va., dated May 20, 1896, says:

> The fishermen hereabouts are having great sport. Large schools of shad, put in Elk River by the Government six years ago, are stranded at Lock No. 2 and are being scooped out by the hundreds with dip-nets. One man took 300 pounds in two hours.

Upon seeing this item the Commission addressed a letter of inquiry to the postmaster at Montgomery, to which Mr. W. M. Dent replied June 5:

> I have sent several of our local fishermen to catch some specimens [of the shad], but I am sorry to say that they are unable to catch them at the present time. A few

weeks ago, when the river was flush, quite a number of fish were seen below the dam near this place, and some of them were caught by what we call grab-hooking, which is to tie a number of hooks to a line and drag it through the water, but since the river has fallen I am informed that most of the fish have disappeared.

I had a talk to-day with the man in charge of the Government lock, and he promised to try to catch some of the fish when there is a rise in the river again. In case he succeeds I will take pleasure in sending them to you.

Mr. Dent was not able to secure any specimens, and nothing further was heard regarding the occurrence of shad in the Kanawha that year. On May 22, 1897, a letter was received by the Fish Commission from Mr. James Sowders, wholesale dealer in fresh fish and oysters, Louisville, Ky., in which he says:

I forward you four small shad. I get them as large as 4 or 5 pounds each. They are not hickory shad, but are the same fish taken in the rivers along the Atlantic coast. I have been getting these fish for the past twenty years or more, but only a few, as we have never fished for them in the right way. I put in the long seines this season and took lots of them. I expect to do much better next season, as I expect to make a success of gill-netting them. We have never fished gill nets of any kind in these waters. I know that there are just millions of these fish in this river, for I see them out in the rapids going up the river to spawn. I have fishermen all along the Ohio, and have several crews fishing below Memphis on the Mississippi River in the early spring, and they get a catch of shad there a month before we do here, and my men at Troy (about 130 miles below Louisville) get them before we do here. I am positive that they are the same fish caught in the Atlantic coast rivers. These shad come from the Gulf of Mexico and spawn in the Monongahela River.

An examination of the four shad sent to the Commission by Mr. Sowders showed that they differed from the common shad, as well as from the Alabama shad, in some important particulars, and it was determined to take the first opportunity to visit Louisville and make an investigation as to the character and extent of the fishery. Accordingly, on May 11 of the following year, when Mr. Sowders sent on six additional specimens, and wrote that the shad were then running in considerable numbers, it was arranged that I should visit Louisville at once.

On the way out from Washington I stopped one day at Montgomery, W. Va., to make inquiries regarding the occurrence of shad in the Kanawha.

Arriving at Louisville on May 15, I spent the next four days making investigations there. The shad were then running in some numbers, and many specimens were examined.

It at once became evident that the Ohio shad was an undescribed species. Its publication, however, has been delayed in the hope that an opportunity might soon offer to trace the migration of the fish up the river from the Gulf. Other duties have not permitted such an investigation to be undertaken, and it now seems undesirable to delay longer the report upon the inquiries already made.

Alosa ohiensis, new species. (Figs. 1 and 2.)

Type, No. 50469, U. S. N. M., a female example 18 inches long and weighing 3 pounds, taken by Mr. James Sowders, May 9, 1898, at the Falls of the Ohio.

Description of the type.—Head 4.5; depth 3.6; eye 5.5; snout 4; maxillary 2.1; mandible 1.87; D. 18; A. 18; gillrakers 49 + 26=75 on right side, 47 + 27=74 on left.

Body very long, slender, and much compressed; dorsal and ventral outlines very gently and evenly arched; head rather long, conic; caudal peduncle very long, the distance from base of caudal to dorsal fin equaling distance from that point to preopercle; mouth large; maxillary broad, reaching posterior border of eye, lower jaw slightly projecting and fitting into a small notch in tip of upper jaw; cheek and opercles strongly striate; scales large and deciduous; fins moderate; gillrakers moderate in number, the longest about equal to snout in length.

The 10 cotypes, which consist of 2 males and 8 females, exhibit no important differences, and the 38 examples examined at Louisville May 16 to 19 showed no variations of value. Indeed, the characters of this species seem unusually stable, as may be seen from an examination of the accompanying table.

The number of gillrakers varies from 66 to 75, only a single example, however, running below 68 and only 5 above 74. The average of 49 examples was 45+26=71 for the right side, and 46+26=72 for the left side. The average for the 4 known adult examples of the Alabama shad is 67, and even the minimum for the common shad is more than 90. In so far as the number of gillrakers is concerned, it thus appears that the Ohio shad is between the other 2 known species, approaching most nearly the Alabama shad (figs. 3 and 4). Indeed, if this species resembled the Alabama shad in other respects as closely as it does in number of gillrakers I would hesitate to regard them as being distinct.

The Alabama shad is a short, chunky species, having the depth one-third the length, and with the maxillary very slender; while the Ohio shad is a much longer, more slender fish, whose depth is scarcely more than a fourth of the length even in the females, while the males are still more slender. And the maxillary in the Ohio shad is broader, more closely resembling that of the common shad (Figs. 5 and 6).

Besides the 4 examples received from Mr. Sowders May 22, 1897, and the 6 received from him May 11, 1898, many others were examined by me at Louisville May 16 to 19, 1898, where I was able to do so through the kindness of Mr. Sowders, who permitted me to examine, weigh, and measure those taken by his fishermen.

In all, 49 fish were examined critically, including 27 females and 22 males.

In looking through the records in the Department of Fishes, U. S. National Museum, I found that a single specimen of shad was received from Louisville in May, 1878, through the kindness of a Mr. Griffith. In the Museum register it is recorded as "*Alosa sapidissima*," and bears tag No. 21346.

The following table gives lengths, weights, gillrakers, and comparative measurements of all the specimens of Ohio shad which have been critically examined.

Tag No.	Sex.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Gillrakers.	
												No. on first arch on right side.	No. on first arch on left side.
		Ins.	*Lbs.*										
*1089	Female	16	2	4.5	3.8	5.5	4.3	2.25	1.7	14	20	47+26=73	46+26=72
1091	do	16	2	4.5	4	5.5	4.3	2.25	1.75	15	19	46+25=71	45+26=71
1090	do	16	2.25	4.5	3.6	5.5	4.25	2.25	1.7	15	19	45+27=72	47+27=74
1092	do	16	2	4.5	3.87	5.5	4.3	2.3	1.75	15	19	46+26=72	46+28=74
1619	Male	15	1.5	4.25	4.4	5.33	4.33	2.13	1.87	17	20	44+27=71	46+28=74
1622	do	16	2	4	3.9	5.5	4	2	1.8	18	19	47+26=73	46+28=74
1620	Female	16.5	2.5	4.4	3.5	5.2	4.2	2.1	1.8	18	20	46+25=71	49+25=74
1621	do	18	3	4.5	3.6	5.5	4	2.1	1.87	18	18	49+26=75	47+27=74
1623	do	15.5	2	4.4	3.6	5	4.5	2	1.83	19	19	43+25=68	44+26=70
1624	do	17.25	3	4.5	3.5	5	4.3	2	1.83	19	20	46+26=72	46+27=73
These 38 specimens, examined at Louisville, were not preserved.	Male	17	2	4.5	3.8	5.75	3.7	1.87	2	.....	.....	45+26=71	46+25=71
	do	16.75	1.75	4.5	3.8	5	3.8	1.87	2	.....	.....	43+26=69	44+27=71
	do	16	2	4.4	4	5.25	3.8	2.1	1.9	.....	.....	45+25=70	45+25=70
	Female	17.5	2.25	4.5	4	5	4	2.1	1.9	.....	.....	46+27=73	44+25=70
	do	17	2.25	4.5	3.75	5.5	4	1.9	1.87	.....	.....	47+25=72	46+26=72
	do	17	2.5	4.2	3.8	5.3	3.8	1.87	2	.....	.....	47+27=74	46+25=71
	do	16.5	2.25	4.4	3.9	5.5	3.8	2	1.87	.....	.....	46+27=73	46+27=73
	do	16	2	4.5	3.9	5.5	3.5	2	1.87	.....	.....	44+26=70	43+25=68
	Male	15.5	2	4.4	4	5	3.5	2	1.75	.....	.....	45+25=70	45+25=70
	Female	16.5	2.25	4.4	3.8	5	3.8	2	1.75	.....	.....	45+26=71	45+28=73
	do	15	2	4.25	3.8	5.25	3.8	2	1.8	.....	.....	45+28=73	47+28=75
	Male	16	2	4.25	3.9	5.25	3.8	2	1.75	.....	.....	45+27=72	46+28=74
	do	16	2	4.4	3.83	5.25	3.8	2	1.8	.....	.....	45+27=72	45+27=72
	do	17	2.25	4.5	4	5	3.8	2	1.8	.....	.....	45+27=72	46+27=73
	do	16	2	4.25	4	5	3.8	2.1	1.8	.....	.....	46+29=75	46+27=73
	do	17	2	4.2	3.9	5.25	3.67	2.1	1.8	.....	.....	45+26=71	45+26=71
	Female	16.5	2	4.25	3.8	5.25	4	2	1.8	.....	.....	44+26=70	46+26=72
	do	17	2.5	4.5	3.9	5	3.67	2	1.8	.....	.....	45+25=70	45+26=71
	do	17.5	2.25	4.5	3.9	5	3.8	2.1	1.75	.....	.....	44+26=70	45+25=70
	Male	17	2.5	.....	.....	.....	.....	.....	.....	.....	.....	47+28=75	47+27=74
	do	17	2.25	.....	.....	.....	.....	.....	.....	.....	.....	45+26=71	47+24=71
	do	17.5	2.5	.....	.....	.....	.....	.....	.....	.....	.....	44+27=71	43+26=69
	do	16	2	.....	.....	.....	.....	.....	.....	.....	.....	43+27=70	45+25=70
	do	16	2	.....	.....	.....	.....	.....	.....	.....	.....	44+26=70	46+25=71
	do	17	2.5	.....	.....	.....	.....	.....	.....	.....	.....	47+28=75	47+27=74
	do	17.5	2.25	.....	.....	.....	.....	.....	.....	.....	.....	45+25=70	46+25=71
	do	17	2.75	.....	.....	.....	.....	.....	.....	.....	.....	45+26=71	44+27=71
	do	16.5	2.25	.....	.....	.....	.....	.....	.....	.....	.....	45+25=70	44+24=68
	do	15	1.75	.....	.....	.....	.....	.....	.....	.....	.....	45+25=70	44+25=69
	do	16	1.75	.....	.....	.....	.....	.....	.....	.....	.....	43+25=68	43+23=66
	Female	18	3	.....	.....	.....	.....	.....	.....	.....	.....	43+25=68	48+23=71
	do	17	2.75	.....	.....	.....	.....	.....	.....	.....	.....	44+25=69	47+27=74
	do	17	2.5	.....	.....	.....	.....	.....	.....	.....	.....	46+24=70	45+26=71
	do	15.5	1.75	.....	.....	.....	.....	.....	.....	.....	.....	45+25=70	45+25=70
	do	16	1.75	.....	.....	.....	.....	.....	.....	.....	.....	45+25=70	44+25=69
	do	15.5	1.5	.....	.....	.....	.....	.....	.....	.....	.....	48+26=74	48+27=75
	do	16	2	.....	.....	.....	.....	.....	.....	.....	.....	45+26=71	45+26=71
	do	16	2.25	.....	.....	.....	.....	.....	.....	.....	.....	46+26=72	46+25=71
21346†	do	18	.....	4.4	3.5	5	4.5	2.1	1.8	15	20	46+26=72	48+24=72

*These 10 specimens have been assigned to certain museums as follows:
No. 1089, cotype, to the Field Columbian Museum, on whose records it is No. 3489.
No. 1090, cotype, to the American Museum of Natural History, on whose records it is No. 2163.
No. 1091, cotype, to the Museum of the University of Indiana, where it is No. 9550.
No. 1092, cotype, to the Museum of Comparative Zoology, where it is No. 28810.
No. 1619, cotype, to the U. S. National Museum, where it is No. 50470.
Nos. 1620 and 1623, cotypes, to the Museum of Leland Stanford Junior University, where they are Nos. 12672 and 12673.
No. 1621, the type, to the U. S. National Museum, where it is No. 50469.
Nos. 1622 and 1624, cotypes, are in the U. S. Fish Commission reserve series.

†No. 21346, cotype, has been in the U. S. National Museum since May, 1878.

During my stay of 4 days at Louisville (May 16 to 19, 1898) the number of shad caught was very few. The catch of May 16 was 19 fish, that of May 17 was 16, while only 3 were gotten on May 18. At this time the roes were quite small, and I think the shad would not have spawned before the 1st to the 15th of June. The examples received

from Mr. Sowders in 1897 and 1898 indicated that their spawning time would have been in the first half of June.

These shad were caught by means of seines light-leaded so that they would fish the upper few feet of water rather than the bottom. This method of fishing was adopted in order to get the spoonbill cat, which, when running, swims close to the surface; and while fishing

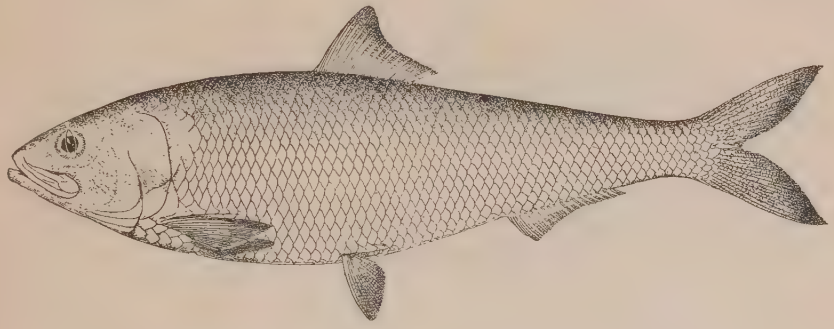


FIG. 1.—Ohio Shad, *Alosa ohiensis* Evermann; female. Drawing from the type.

for the spoonbill, the shad were caught at the same time. The two species appear to "run" at the same time when both swim near the surface.

The principal seining-ground near Louisville in 1898 was below the Falls of the Ohio, and between Rock Island and the Indiana shore. The seines in use were about 70 yards long, 1.5-inch bar, and 90 meshes deep.

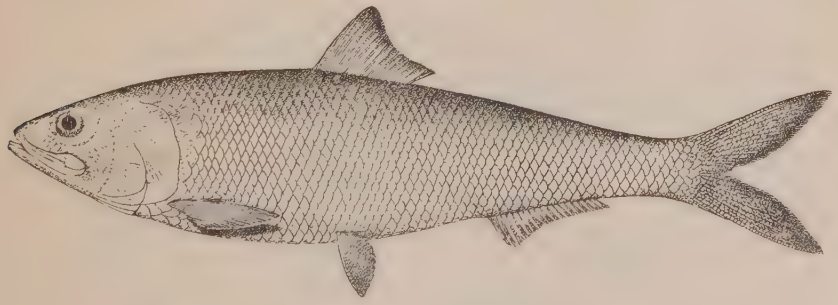


FIG. 2.—Ohio Shad, *Alosa ohiensis* Evermann; male. Drawing from one of the cotypes.

According to Mr. Sowders the first shad obtained at Louisville were caught about 1876, when a good many were secured by seining just below the Falls. Mr. Sowders's father, who was then in the fish business, compared them with shad billed to him from Baltimore as "Potomac shad." Being unable to detect any important difference, he called those from the Ohio "Potomac shad," which name they have ever since retained among the Louisville fish-dealers. They found a ready sale then, perhaps at a better price than they now receive. Since

that time a few have been taken each year, but no large catches until 1897. The catch that year was relatively very large. The first fish were gotten May 5, and from then until May 20 the daily catch at Mr. Sowders's fishery at the Ohio Falls ran from 125 to 740 fish.

Mr. Sowders thinks the great increase in the catch in 1897 was due to a change in the method of fishing. Until then the seines had been

FIG. 3.—Alabama Shad, *Alosa alabamæ* Jordan & Evermann; male. Drawing from the type.

heavily leaded, hence hugged the bottom closely and caught only bottom fish, the seines not being deep enough to fish the entire depth of water. The catch was made up chiefly of such bottom fish as catfish, buffalo, and fresh-water drum. The surface-swimming fish, such as the spoonbill cat, shovelnose sturgeon, and shad, would pass over the net. Desiring to catch the spoonbill cat, Mr. Sowders instructed his fishermen to put lighter leads upon the seines, so that they would

FIG. 4.—Alabama Shad, *Alosa alabamæ* Jordan & Evermann; female. Drawing from the type.

fish the upper portion of the water. As a result, not only were the spoonbill cat and shovelnose sturgeon taken, but the shad also. All three of these species appear to run at about the same time.

The first shad caught in 1898 were gotten April 28. The catch in that year was said to have been much lighter than in 1897; but the catch of all species in 1898 was light.

Very little is known regarding the distribution of the Ohio shad. All the specimens I have seen were taken at the Falls of the Ohio. About March 15, 1898, Mr. Sowders was at Coahoma, Miss., where he saw 25 or 30 shad caught. This was in the Mississippi about 10 miles below Friars Point, Coahoma County, or about 75 miles below Memphis. The fishermen said they caught a good many of them, but

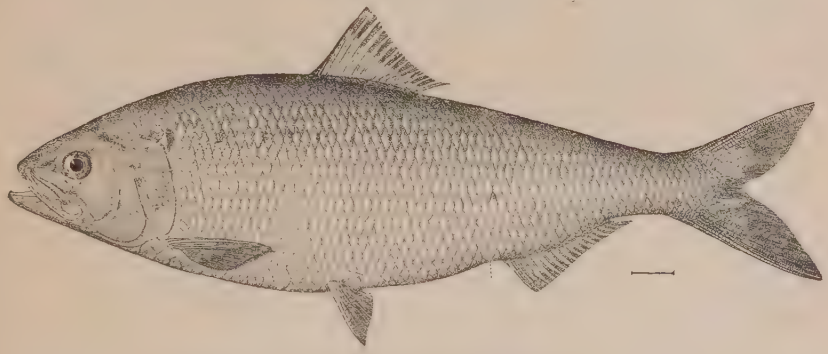


FIG. 5.—Common Shad, *Alosa sapidissima* (Wilson); male.

were uncertain what they were. Some called them "skipjack," but believed them different from the common skipjack (*Pomolobus chrysochloris*). These fishermen said they had been getting this fish for years, but never valued them very highly. They used them chiefly for cat-fish bait. The roes of those which Mr. Sowders saw were very small.

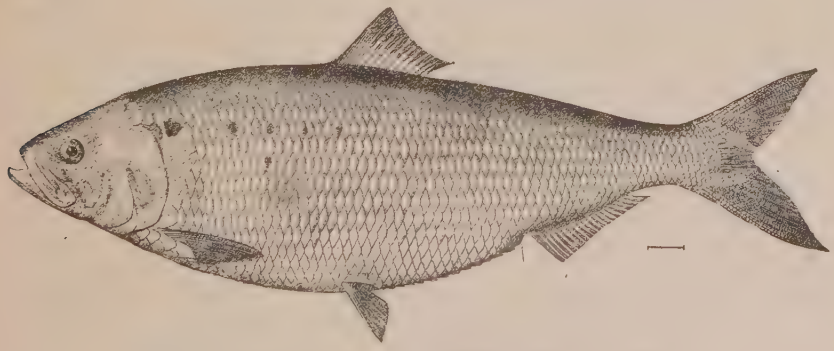


FIG. 6.—Common Shad, *Alosa sapidissima* (Wilson); female.

The next place from which this shad has been reported is Flint Island, in the Ohio River, a mile below Concordia, Ky., or about 90 miles below Louisville. Mr. Sowders reports that he got shad there in small numbers about April 20, 1897. They were seen at Brandenburg, Ky., about 40 miles below Louisville, about the same time.

Mr. Sowders says he heard of the shad at Vicksburg about 1883, and in 1884 in the Ohio at Hickman; also at Aurora, Ind., in 1886 and subsequently.

As already stated, the Fish Commission heard of the occurrence of shad in the Kanawha River at Montgomery, W. Va., in May, 1896. On May 13, 1898, I visited Montgomery, hoping that I might be able to secure specimens, or at least obtain further data regarding the occurrence of shad at that place. Very little additional information, however, could be secured. It was learned that shad had never been seen there, according to the persons interviewed, until in May, 1896. Only a few people knew anything about them, and not many were caught. The fish were seen at Lock No. 2, which is at the town of Montgomery, and at Lock No. 3, which is 5 or 6 miles below.

According to Mr. Pink Brown, shad were abundant during the "light moon in May, 1896," in the Kanawha at Cabin Creek, just below Coalburg, or 8 miles below Montgomery. The river was full of them and he caught a great many with a seine. He sold none because everybody was catching them. He took some to Capt. James Calvert, of the *Kanawha Belle*, who said they were common all along the river. Mr. Brown says those he caught were fine, large fish, excellent eating, and full of roe when caught, but he did not notice any eggs running from them, though others reported that they did. Mr. Brown did not catch any shad after the "light moon in May," but other parties continued for some days to catch them at the locks with drag hooks.

Several years ago, it was stated, copperas water from the Cannelton mines entered the river and killed many fish, among them a "whitefish" which many now believe was the shad. The fishermen and others in this region who are familiar with the toothed herring and the skipjack say that the fish they call the shad is a very different species.

Lock No. 2, at Montgomery, is on the north side of the river and is faced by a high stone wall, on the outside of which, in the swift water, is where the shad were caught. For some time I watched a man with drag hooks trying for shad, but he met with no success.

Inquiry among the fish-dealers at Evansville, Ind., in May, 1898, developed the fact that the shad is scarcely known at that place. One dealer stated that he had seen shad caught in the Ohio near Evansville about 1868 and a few in 1897. He also stated that he had taken them in the Wabash, about 10 miles above its mouth. He gave the weight of the shad as about 2 pounds, and says they die very soon when caught.

Only one of 3 dealers interviewed at Vincennes, Ind., had ever heard of shad in the Mississippi basin. He claimed to have received some shad a few years ago from St. Louis, but says they were too expensive for his market, as he had to sell them at 75 cents each. He did not know but that these fish may have been shipped from the East.

All the known facts regarding the distribution and habits of the Ohio shad indicate that it has regular runs, like the common shad.

It appears in the Mississippi on the borders of Coahoma County, Miss., about the middle of March; in the lower Ohio about a month

later (April 20); at Louisville still a little later (April 28 to May 20), and in the Kanawha River at Montgomery, W. Va., in the latter part of May.

The Ouachita River, Arkansas, from which shad have been reported, has its mouth in the Red River near the confluence of the latter with the Mississippi, more than 200 miles below Coahoma, where they were seen by Mr. Sowders, and only about 200 miles from the Gulf of Mexico. Although it has not been proved that these shad come up from the Gulf of Mexico, it may be regarded as certain that they do and that they are as truly anadromous as is the Atlantic shad.

Whether important fisheries for the Ohio shad can be established remains to be determined. In the first place, it is not yet known whether the fish is commercially abundant. It is not at all improbable that its apparent scarcity may be due merely to the fact that the methods of fishing in vogue in the Mississippi basin have not been such as would prove effective in the capture of shad. Gill nets and trap nets are scarcely known, and where seines are used they are usually leaded so as to fish the bottom, and are hauled mostly during the daytime. Shad might very well be present in abundance and remain forever unknown so long as the present fishing methods are continued.

Many plants of Atlantic shad have been made by the United States Fish Commission in the waters of the Mississippi basin—the first in 1874 and the last in 1893—and although none of the planted shad has since been received by the Fish Commission for identification, and the capture of none has been fully authenticated, it does not follow by any means that none has survived. It is by no means improbable that the Atlantic shad may now be abundant in the Gulf and its tributary streams, and that a thorough investigation may establish the fact. At any rate the vast economic and scientific importance of the matter justifies a very careful and exhaustive investigation of the whole matter.

The spawning time of the shad in the Ohio River is probably not earlier than the 10th of June. The numerous examples seen at Louisville May 16 to 19 were far from ripe and it is doubtful if any of them would have spawned much before the middle of June.

As an article of food the Ohio shad does not yet seem to have appealed to the citizens of the Mississippi Valley. At Louisville they sold at a low price, the price received by the fishermen being but 2 cents a pound, the same that was paid for carp, buffalo, and toothed herring. Those who are familiar with the delicious Atlantic shad and who know how to prepare it find the Ohio species not at all inferior.

If the shad should be found to be present in the Mississippi and its tributaries in sufficient numbers to justify the establishment of permanent fisheries each spring, there is little doubt but that it would soon become quite as highly prized as its near relative in the Atlantic coastal streams.

NOTES ON OTHER FOOD-FISHES OBSERVED AT THE FALLS OF THE OHIO.

During the visit to Louisville for the purpose of studying the Ohio shad several other food-fishes were observed and many important notes were made upon them, the more valuable and interesting of which are here recorded.

In the fishery at Louisville the species caught are classed as "good fish," "small fish," and "shovelnose sturgeon." Spoonbill cat and fresh-water drum are classed as "good fish," and all other species as "small fish," except the shovelnose sturgeon, which is classed by itself.

Polyodon spathula (Walbaum). *"Spoonbill Cat"; Paddle-fish.*

This is one of the most interesting fishes of the Ohio basin. It is said to occur in the Kanawha at least as far up as Montgomery. At Louisville it is the most valued of all the fishes found there. It is only within the last few years that the spoonbill cat has possessed much commercial value, but now it is more sought after than any other species in the Mississippi basin. Although its principal value is on account of its roe, from which caviar is made, the flesh has now come into considerable favor and finds a ready sale.

The paddle-fish is found in the Ohio, at Louisville, in the spring in large numbers. The fishing season is chiefly during the month of May, at which time the fish are running upstream. The principal fishery is just below the Falls, where the fish are taken in the same seines which are used in the shad and shovelnose sturgeon fisheries.

During my stay at Louisville (May 16 to 19) I saw a good many of these fish caught and examined many examples in Mr. Sowders's market. When the spoonbills are caught the fisherman cuts off the heads (including the collar bones), the tail, and all the fins, and then receives 4 cents a pound for what is left. The majority of those seen were small, probably running from one-half to 15 pounds dressed. Some were not over a foot in length. Nearly all the large ones were females full of nearly ripe roe. The eggs did not run from any that I saw, but the fishermen say they had a few recently which were entirely ripe.

Just where these fish spawn no one knows certainly. Mr. Sowders and the fishermen think they go to the bayous and quiet places in the river above Louisville. Judging from the roe I saw in May, I would say that many of the fish examined would have spawned early in June—perhaps between June 5 and 20—and it would seem that it should not be difficult to discover their spawning-beds.

There is, however, no other fresh-water fish in our waters about whose spawning time, place, and habits, and whose development so little is really known, although their eggs and young have been long desired by all zoologists interested in the origin and development of fishes. No one seems ever to have seen this fish spawning, and the young under 8 or 10 inches in length are absolutely unknown. Anyone obtaining specimens under 8 inches in length would confer a great favor upon science by forwarding them, preserved in formalin, to the U. S. Fish Commission at Washington.

The utilization of the roe of the spoonbill cat began only a few years ago, and it is now by far the most valuable part of the fish. The eggs are a greenish-black in color, about three times the size of shad eggs, and are very numerous. In converting them into caviar they are run through a wire screen to separate them from all the fat and connective tissue; then they are salted by mixing with them the proper amount of Lüneburg salt. This is the most delicate part of the whole process and the best results can be obtained only by practice. After adding the salt the eggs at

first become dry, but in a few minutes a brine has been formed. The salted eggs are then placed on fine-meshed sieves, where they are allowed to drain, after which they are packed in casks or cans as caviar. The method does not differ from that followed with the eggs of sturgeon.

Mr. Sowders says that 1897 was his best year. In 1898 he got considerable quantities at various places down the Mississippi in March.

Acipenser rubicundus Le Sueur. *Lake Sturgeon; Ohio Sturgeon.*

The sturgeon ascends the Kanawha at least to Montgomery, but it does not appear to be common anywhere in the Ohio basin. This species was formerly much more abundant in the Ohio, and I have seen a very large example with ripe roe at Louisville in March.

Scaphirhynchus platorhynchus (Rafinesque). *Shovelnose Sturgeon.*

This is a rather abundant fish at Louisville. They are taken in seines with the spoonbill cat and the Ohio shad, as they run at the same time with those species and also swim well toward the surface of the water when running. The fisherman ties them in bunches (2 to 4 in a bunch, which weighs about 4 pounds), for which he receives 10 cents each. The accompanying table gives the weight and length of 41 males and 21 females examined.

Table showing sex, length in inches, and weight in pounds of 62 shovelnose sturgeon examined at Louisville, Ky., May 16 to 19, 1898.

Sex.	Length.	Weight.	Sex.	Length.	Weight.
	Inches.	*Pounds.*		*Inches.*	*Pounds.*
Male	21	2	Male	21	1.5
Do	25	2.25	Do	19	1.25
Do	25.5	2.5	Do	21	1.5
Do	24	2.5	Do	21	1.5
Do	27	3	Do	21.5	1.75
Do	21	1.5	Do	19	1.25
Do	23	2	Do	18.5	1.25
Do	21	2	Do	19	1.25
Do	21	2	Do	16.5	1
Do	25	2.75	Do	18	1.25
Do	24	2.5	Female	26	3.75
Do	20	1.5	Do	22	2
Do	22	2	Do	25	3.25
Do	26	3	Do	27	4
Do	22	2	Do	26	3.5
Do	20	1.5	Do	25	3
Do	24	2.75	Do	24.5	2.75
Do	24	2.25	Do	26	3
Do	22	1.5	Do	26	3.5
Do	21	1.75	Do	23	2.75
Do	24	2.5	Do	26	3
Do	22	1.75	Do	28	4.25
Do	20	1.5	Do	23	2.5
Do	21	1.75	Do	27	4
Do	24.5	3	Do	26	3.25
Do	21	1.5	Do	29.5	4.75
Do	20	1.25	Do	26	4
Do	21	2	Do	25	3
Do	20	1.5	Do	26	3
Do	20	1.5	Do	24	2.75
Do	24	2.25	Do	22	2

The total number of examples of this species examined critically was 62, of which 41 were males and 21 females. The smallest male was 16.5 inches long and weighed 1 pound; the largest male was 27 inches long and weighed 3 pounds; the average length of the males was 21.7 inches, and the weight 1.89 pounds. The smallest female was 22 inches long and weighed 2 pounds; the largest female was 29.5 inches long and weighed 4.75 pounds; the average length of the females was 25.4 inches, and the average weight 3.24 pounds.

In addition to these 62 fish examined, I measured, but did not determine the weight or sex of, 78 others. Of these the smallest was 18 inches long, the largest 28

inches, and the average length was 22.57 inches. These fish were all much smaller than the books usually indicate this species to be. The largest I have ever seen was under 4 feet long.

Rafinesque, in writing of this fish in 1820, in his Ichthyologia Ohiensis, says:

"A singular species, very common in the Ohio, Wabash, and Cumberland in the spring and summer, but seldom reaching as high as Pittsburg. It appears in shoals in March and disappears in August. It is very good to eat and bears many names, such as spade-fish, shovel-head, flat-head, flat-nose, etc., having reference to the shape of its head, which is flattened somewhat like a spade. It is also found in the Mississippi and Missouri, where the French call it *La pelle*, or *Poisson pelle*, which has the same meaning. Size, from 2 to 3 feet; greatest weight, 20 pounds."

The eggs of the shovelnose sturgeon are used at Louisville in the making of caviar, and are mixed with those of the spoonbill cat. They are a little smaller and somewhat darker than those of the latter species. The majority of the fish examined were not nearly ripe, and their spawning time is probably not earlier than July or late in June.

Ictalurus furcatus (Le Sueur). *Blue Cat.*

Several examples seen at Louisville, where it is a valued food-fish. Rafinesque, in his Ichthyologia Ohiensis, mentions this cat-fish under the name *Silurus cerulescens*. He calls it "a fine species, reaching sometimes a very large size. I have been told that one was taken weighing 185 pounds, and another 250 pounds. Vulgar names, blue cat, brown cat, and cat-fish."

Ictalurus anguilla Evermann & Kendall. *Eel Cat; Willow Cat.*

One example of this recently discovered and interesting species was seen at Louisville, May 18. Length 9 inches to base of caudal; weight 1.5 pounds. Head 3.83; depth 5.75; eye 6.67; snout 2.8; width of mouth 2.3 in head; maxillary barbel reaching gill-opening; distance from snout to origin of dorsal fin one-third length of body.

Ictalurus punctatus (Rafinesque). *Channel Cat.*

More common than the preceding, but not reaching so large a size.

Ameiurus nebulosus (Le Sueur). *Common Bullhead.*

A few examples seen at Louisville.

Leptops olivaris (Rafinesque). *Goujon.*

A large and important food-fish not uncommon in the Ohio; several examples seen at Louisville.

Ictiobus bubalus (Rafinesque). *Small-mouthed Buffalo.*

Seen only at Louisville, where it was taken in seines along with the paddle-fish and shad.

Carpiodes carpio (Rafinesque). *Carp Sucker.*

This species was originally described by Rafinesque from the Falls of the Ohio, where it is commonly called carp. Several examples seen by me.

Cycleptus elongatus (Le Sueur). *"Black Sucker"; "Mississippi Sucker"; Gourd-seed Sucker.*

This interesting sucker is found sparingly at Montgomery. It runs early in the spring, ahead of the shad, reaching Montgomery early in May. A fisherman at this place says they reach a weight of 15 pounds. They will not take the hook and are usually caught at the lock by "grab-hooking." A few examples of this sucker were seen at Louisville, where it is said to be most abundant in the fall. It reaches a considerable size, examples of 18 pounds having been reported. It is a sweet, delicious fish, and finds ready sale.

Carpiodes velifer (Rafinesque). *Quillback; "Carp."*

Not rare at Louisville, where it is called "carp."

Catostomus commersonii (Lacépède). *Common Sucker.*

At Montgomery this sucker was seen salted in brine in kegs of about 100 pounds each. They had been received from Charleston, W. Va., where they presumably had been put up. They had been billed to the dealer at Montgomery as "white-fish," and were sold by him under that name at 2 for 5 cents. In the same keg were seen a few common redhorse (*Moxostoma aureolum*) and one-toothed herring (*Hiodon alosoides*). They are said to sell fairly well and there is no good reason why these coarser fish might not be utilized extensively in this way.

This sucker is common throughout the Ohio basin, but was not seen by me at Louisville.

Moxostoma aureolum (Le Sueur). *Common Redhorse.*

A few examples of this fish were seen at Montgomery in a keg of pickled common sucker (*Catostomus commersonii*). It is not uncommon at Louisville, where a number of specimens were seen.

Cyprinus carpio Linnæus. *German Carp.*

The German carp has become well established in the Ohio River and considerable numbers are caught each year. Though a much maligned fish, the carp has come to be one of the most important fresh-water food-fishes of the Mississippi Valley. In the Illinois River it is of greater value to the fishermen than all other species combined; and instead of destroying the black bass, as many anglers and others would have us believe, the black bass have actually increased along with the carp in that river.

Anguilla chrysypa Rafinesque. *"Eel"; Common Eel.*

The eel is not uncommon, at least as far up as Montgomery, where I saw one taken on a hook at the lock. It occurs at Louisville, but no specimens were seen during my visit.

Hiodon alosoides (Rafinesque). *Toothed Herring.*

One example was seen in a keg of pickled suckers in a grocery at Montgomery, where they were all sold as "white-fish," at two for 5 cents.

This species was seen at Louisville, where it was not common. It is classed among the "small fish" for which the fishermen receive 2 cents a pound.

Dorosoma cepedianum (Le Sueur). *Hickory Shad; Gizzard Shad.*

An abundant fish in the Ohio Valley, of little or no value as food. Several seen at Louisville.

Stizostedion vitreum (Mitchill). *"Salmon"; "White Salmon"; Wall-eyed Pike.*

This valuable species seems to be rather uncommon in the Ohio and its larger tributaries. At Montgomery it is said to be their best game fish, and is caught by trolling with an artificial minnow. It is said to reach a weight of 18 pounds in the Kanawha. No examples were seen either there or at Louisville.

Aplodinotus grunniens Rafinesque. *"White Perch"; "Yellow Perch"; Fresh-water Drum.*

This large, coarse fish seems to be quite common in all the larger streams of the Ohio basin. I saw it caught on a hook at Lock No. 2 just below Montgomery. A good many are caught in seines at the Falls of the Ohio, where it brings the fishermen 4 cents a pound. About a dozen were examined May 16, the largest of which weighed about 5 pounds. The next day one of 13 pounds was caught. This fish is highly prized and meets with a ready sale.

At Louisville I did not hear the names drum, sheepshead, or gaspergou, by which this interesting species is usually known. It is there generally called the white perch or yellow perch. Among the common names which Rafinesque heard applied to this fish along the Ohio he mentions white perch, white pearch, buffalo perch, grunting perch, bubbling perch, bubbler, and mussel-eater. He further says that—

"It is one of the largest and best found in the Ohio, reaching sometimes to a length of 3 feet and a weight of 30 pounds, and affording a delicate food. It is also one of the most common, being found all over the Ohio and even in the Monongahela and Allegheny, as also in the Mississippi, Tennessee, Cumberland, Kentucky, Wabash Miami, etc., and all the large tributary streams, where it is permanent, since it is found at all seasons except in winter. In Pittsburg it appears again in February. It feeds on many species of fishes—suckers, cat-fishes, sun-fishes, etc., but principally on the mussels, or various species of the bivalve genus *Unio*, so common in the Ohio, whose thick shells it is enabled to crush by means of its large throat teeth.

"The structure of those teeth is very singular and peculiar; they are placed like paving stones on the flat bone of the lower throat, in great numbers and of different sizes; the largest, which are as big as a man's nails, are always in the center; they are inverted in faint alveoles, but not at all connected with the bone. Their shape is circular and flattened, the inside always hollow, with a round hole beneath. In the young fishes they are rather convex above and evidently radiated and mammillar, while in the old fishes they become smooth, truncate, and shining white.

"A remarkable peculiarity of this fish consists in the strange grunting noise which it produces, and from which I derived its specific name. It is intermediate between the dumb grunt of a hog and the single croaking noise of the bullfrog. The grunt is only repeated at intervals and not in quick succession. Every navigator of the Ohio is well acquainted with it, as they often come under the boats to enjoy their shade in summer, and frequently make their noise.

"Another peculiarity of this fish is the habit which it has of producing large bubbles in quick succession while digging through the mud or sand of the river in search of mussels or unios. * * * This fish is either taken in the seine or with the hook and line; it bites easily, and affords fine sport to the fishermen. It spawns in the spring, and lays a great quantity of eggs."

The otoliths or ear stones of this fish are unusually well developed, and are familiar to the boys along the Ohio as "lucky stones."

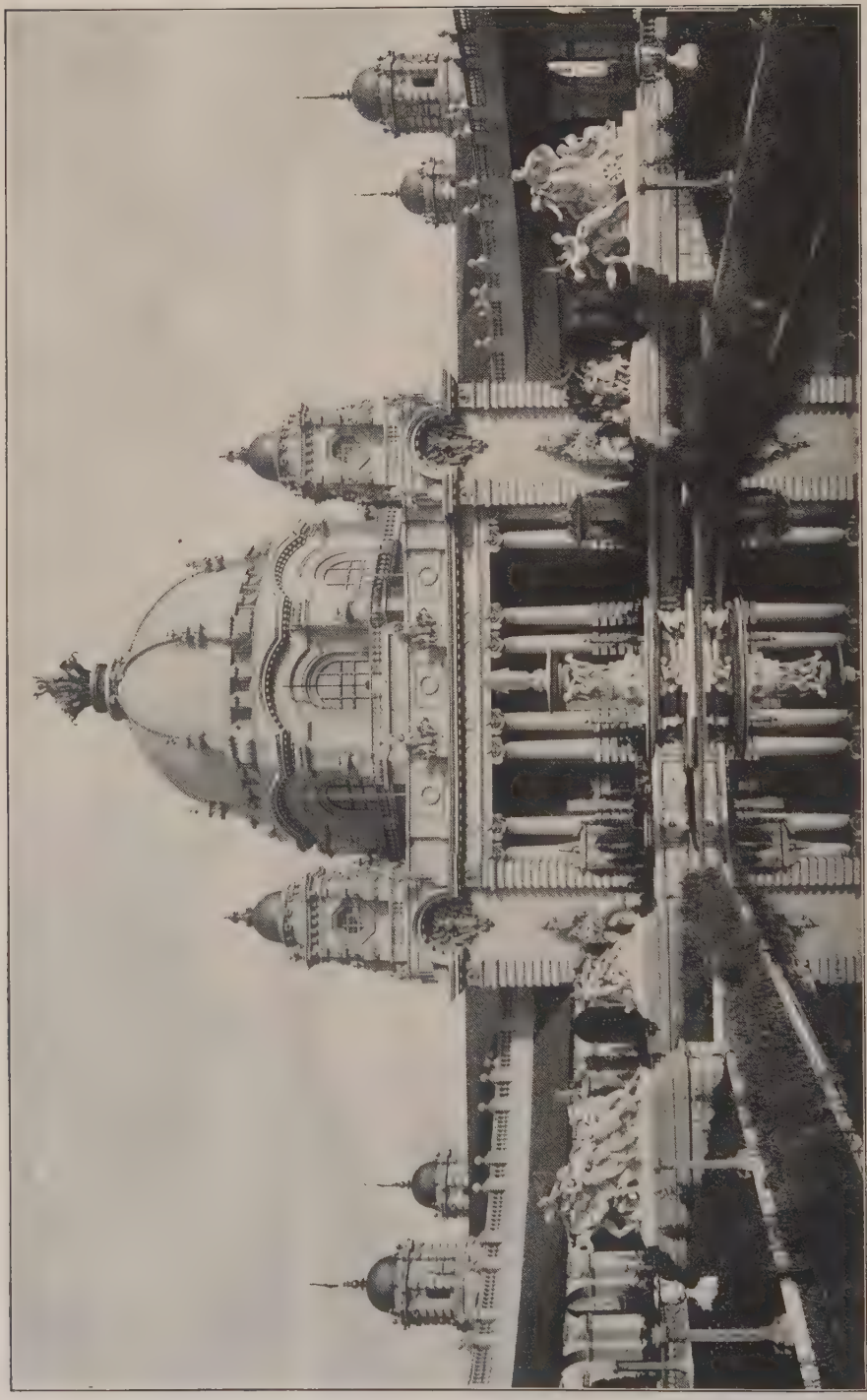
THE PAN-AMERICAN EXPOSITION.

REPORT

OF THE

REPRESENTATIVE OF THE U. S. FISH COMMISSION.

By W. de C. RAVENEL.



MAIN SECTION OF GOVERNMENT BUILDING.

THE PAN-AMERICAN EXPOSITION—REPORT OF THE REPRESENTATIVE OF THE UNITED STATES FISH COMMISSION.

By W. de C. Ravenel.

Under the act of Congress approved March 3, 1899, providing for the participation of the United States Commission of Fish and Fisheries in the Pan-American Exposition, for the purpose of illustrating its functions, the Commissioner appointed W. de C. Ravenel, the assistant in charge of the Division of Fish Culture, as the representative on the Government Board of Management.

Of the amount appropriated in the act above referred to $40,000 was allotted for the preparation, installation, and maintenance of the Fish Commission exhibit in the south pavilion of the Government building. This building, 140 feet square, contained about 10,000 available square feet of space for exhibition purposes, 6,500 feet being set aside for an aquarium and the balance for the exhibits embraced under the three heads, scientific inquiry, fish-culture, and methods and statistics, and arranged as shown on plates 16–20.

DIVISION OF SCIENTIFIC INQUIRY.

The aim of the exhibit of the Division of Scientific Inquiry was to illustrate the methods and apparatus employed by the Fish Commission in conducting its investigations and some of the results attained by their use. Many of the instruments used in the laboratory—microscopes, microtomes, dissecting instruments—were known to the public, and the purpose was therefore to utilize the available space for an exhibit of apparatus used in making shore and deep-sea collections, most of which was invented or modified by persons in the service of the Commission.

The arrangement of the exhibit was as follows:

Facing the aisles were models of the *Albatross* and *Fish Hawk*, the largest vessels belonging to the Fish Commission, to which we owe much of our present knowledge of the life in the deep waters off the coasts of the United States and in the West Indies. The *Fish Hawk*, besides carrying on marine biological investigations, is also used during certain seasons of the year as a hatchery for the propagation of shad and other economic marine animals, a service in which she has rendered valuable aid in perpetuating the fisheries. The *Albatross* was designed especially for the investigation of the off-shore fisheries and has done more work in deep-sea research than any other vessel in the

world. Her equipment is especially complete, and she is provided with convenient and ample laboratory facilities for the study and preservation of specimens.

Running diagonally across the section from the circular aisle of the rotunda was a display of the common forms of apparatus employed in marine investigation. The beam trawl which was spread on the floor is the most efficient apparatus for gathering specimens from the bottom of the ocean, and has been used by the *Albatross* in a depth of 4,200 fathoms, about 4¾ miles. Hanging to the frame above the trawl were several appliances used in collecting from the surface, bottom, and intermediate depths. The tangle, which, as its name indicates, entangles specimens in its hemp or manila swabs, is used where the bottom is so rough and foul that trawls and other forms of nets would be torn or otherwise seriously damaged. The Chester dredge, with its hooks, is used to catch worm-like animals and certain species of mollusks which habitually burrow in the mud of the bottom. The ordinary dredges are used from very small boats in shallow water, or from the steamers when, for some reason, it is impracticable to use the beam trawl. They not only scrape up animals lying on the bottom, but also dig up organisms which burrow but slightly.

In all of the apparatus used for bottom collecting, the contents are emptied into a series of sieves on the deck of the vessel, and after being washed, to remove the mud and sand, are carefully assorted and the specimens placed in suitable reagents, usually alcohol, and preserved for study in tanks, bottles, and other receptacles.

The large surface tow net, which is lined with even-mesh silk bolting-cloth, is used in collecting the wealth of life swarming on the surface of the water. The surface or pelagic life, much of which is minute, is extremely important to the fisheries, as it supplies, directly or indirectly, the food for most of the denizens of sea and lake.

In the study of life at intermediate depths the open net is unsuitable, as it catches specimens while it is being hauled to the surface, and the depth at which a given specimen is caught is indeterminate. To obviate this difficulty and to enable the investigator to determine with accuracy the depth from which his specimen came, two forms of net are employed by the Fish Commission. They are towed at the depth which it is desired to study, and before being hauled in are closed by a messenger or weight which slides down the wire rope by which they are towed and actuates a device connected with the frame of the net.

Draped on the frame over the trawl and otherwise disposed about the section were seines, gill nets, scoop nets, scrape nets, and other apparatus used in making shore collections of fishes and other organisms.

The collecting tanks and chests in which specimens are preserved and transported were shown by the side of the trawl, and adjacent to them was a Tanner sounding machine, with its accessory apparatus for obtaining the bottom temperature and specimens of the bottom

and of the stratum of water immediately above it. These data are always obtained at each station where the trawl or other apparatus for bottom collecting is used.

Practically all forms of aquatic life are directly or indirectly related to the fisheries and are therefore appropriate to the work of the Fish Commission. In cases arranged around the boundaries of the section were specimens of animals which constitute an important, although economically small, part of the yield of the various forms of apparatus just mentioned.

An exhibit of oysters illustrated the rate of growth, the modifying effects of varying local conditions, the principal enemies, and other matters connected with the life history of that important mollusk which constitutes by far the most valuable item in the yield of our fisheries. Among the other economic mollusca were exhibits of several kinds of clams and other species used either as food or bait, or both.

The crustacean exhibit included crabs, shrimp, lobsters, and related forms which are important as food for man, as fish food, or which are employed by the fishermen for bait. A number of Porto Rican species were shown which do not occur on the coasts of the United States or which, occurring, are not utilized as food.

In the frames immediately above the cases were examples of plates, mostly colored, used in illustrating the publications of the Fish Commission. Above these was a series of charts showing the geographical distribution of the most important food-fishes of the Great Lakes, the colored areas marking the regions in which the species are known to occur. A large map indicated the regions where the Fish Commission has carried on scientific investigations.

A complete list of all the material exhibited under this section may be found on pages 306–314.

DIVISION OF FISH-CULTURE.

Under this heading were grouped the exhibits which illustrate the fish-cultural work of the Commission, embracing full-sized forms of apparatus and models of all the appliances used in collecting eggs, the hatching of fresh and salt water fishes and the distribution of the same, also photographs and drawings showing the different phases of the work and the results of fish-culture in certain of the fisheries.

From the opening of the exposition, May 1, to its close, November 3, the practical work of hatching trout, salmon, shad, and pike perch was demonstrated. Suitable troughs were provided for the hatching of quinnat and other salmon of the Pacific coast, and grayling, brook, rainbow, steelhead, and black-spotted trout from the interior waters; tables were equipped with automatic jars for hatching shad and pike-perch eggs, and cod-boxes illustrated the methods of hatching the eggs of marine species. On April 30th, 4,000,000 pike-perch eggs were received from Put-in Bay, Ohio, and on May 4th another consignment

arrived. Owing to the low temperature of the water it was not deemed advisable to attempt the hatching of shad eggs until June 5th, when a million were brought from the Delaware River. These hatched in a few days, and the resulting fry, together with the pike-perch fry, were planted in the Niagara River. On May 11th the first consignment of rainbow-trout eggs arrived from Leadville, Colo. From then until August the troughs were kept supplied with eggs of the rainbow, black-spotted, and steelhead trout, and the grayling. The first consignment of quinnat-salmon eggs reached Buffalo on September 6, having been shipped on the 1st from Baird, Cal.; other consignments arrived on the 23d, and on October 11th 25,000 lake-trout eggs were received from Duluth, Minn. All of the eggs were hatched with little or no difficulty, and the fry, after serving the purpose of an exhibit, were turned over to the Niagara County Angling Club for stocking streams in the vicinity of Lockport, N. Y. This exhibit proved a most attractive and instructive feature of the Exposition, as evidenced by the large crowds constantly in the vicinity of the troughs.

It is a matter of regret that it was impracticable to hatch any of the eggs of the marine fishes propagated by the Commission, owing to the fact that the spawning season of none of these occurred while the Exposition was open.

Another attractive feature was the working model of the Cail fishway, as modified by the architect of the Fish Commission, Mr. H. von Bayer. Young trout placed at the foot of the raceway made their way in a few minutes to the top.

An aquarium was provided, which occupied about 6,500 square feet. Around the side of the building, which was rectangular in shape, a circular corridor was arranged, on one side of which were 32 tanks, varying in size from 7 feet long, 5 feet wide, and 3 feet high to 3 feet long, 5 feet wide, and 3 feet high, in which were shown not only all of the fresh and salt water fishes propagated by the Commission, but also all of the important economic and food-fishes of the North Atlantic coast and the inland waters east of the Rocky Mountains; a few of the Salmonidæ from the Pacific slope were also included. The corridors were in semidarkness, while the tanks were lighted from the back, thus making all of the animal life they contained plainly visible. Across the corridor from the tanks were mirrors to give the corridor the effect of increased size. The ceiling was constructed in Roman style of architecture, with groined arches radiating from columns located on either side of the tanks and terminating at circular drums or ventilators. The portion below the aquaria line was of sheet metal, forming below each tank a panel of rock-face stone; this was painted in a dark sea green, while the upper portion blended into a lighter color; the ribs, columns, and moldings were treated in a cream white.

The tanks for the display of fresh-water fishes were supplied with water from the Niagara River, which was furnished free of expense

by the Exposition company. The salt water was brought from Woods Hole, Mass., transported in cars loaned by the Union Tank Line Company of New York. This water was stored in the basement of the building in large settling tanks, from which it was pumped through hard-rubber pipes, by means of nickel pumps driven by electricity, into a tank 20 feet above the aquaria, from which it entered the aquaria by gravity through hard-rubber pipes, the rubber being used because our experience at Omaha and other points led us to suspect that the quality of the salt water had been affected by the use of iron and other metal pipes.

Provision was made for an 8-ton Remington ice machine for reducing the temperature of the water in summer, so that the Salmonidæ and other fishes requiring cold water could be displayed throughout the period of the Exposition. Arrangements were also provided for heating the salt water during the early and late days of the Exposition, when the temperature of the water would be lower than the water from which the fish had been taken.

For the details of the construction of the aquarium, and the installation of the machinery, reservoir, and supply tanks, reference is made to the accompanying plans, which also show the system of pipes used for the circulation of both salt and fresh water.

The casual visitor looking at the aquarium little realizes the difficulties of maintaining a salt-water exhibit a thousand miles from the ocean. Arrangements must first be made to secure a supply of pure salt water, of a density ranging from 1.013 to 1.018, from some point where the railroad facilities allow the cars to be placed on the docks so that the water can be conveniently pumped into them. To obtain pure water the point selected must necessarily be distant from large cities. So far the Commission has found only two points on the Atlantic coast where comparatively pure salt water can be readily secured, namely, Woods Hole, Mass., and Morehead City, N. C.

The success of the aquaria, after suitable water has been secured, depends very largely on the conditions under which the fish are captured and the care and celerity with which they are transported to their destination. They should be caught with such devices as will prevent their being bruised or cut, and with little or no loss of scales, and they should be very carefully handled from the time they are captured until they are placed in the aquarium. This is a difficult problem at best, and especially when it is borne in mind that we are obliged to depend very largely on the commercial fishermen, who are accustomed to handle their fish somewhat roughly, as their only object is to catch them and place them in the market as quickly as possible.

As very few species of the salt-water fishes could be obtained on the New England coast before the middle or end of May, those exhibited at the opening of the Exposition were collected from Morehead City, N. C., both on account of its railroad facilities and the abundance of

fishes at that season. Forty species, including crustaceans and mollusks, were shipped on the 20th of April to Buffalo. These were supplemented by ten or fifteen more from Woods Hole, Mass.

Bad weather on the coast of North Carolina seriously hampered the work during April, so that when the car reached Buffalo, two days before the Exposition, the number of fish delivered in good condition was comparatively small, though better than had been anticipated under the circumstances. Some of the fishes were bruised, and the losses during the first few days were large, but it is worthy of note that at the close of the Exposition in November there was still in the aquarium a number of fish brought from North Carolina in April on the first trip.

In May a carload of salt-water fishes was received from Woods Hole, Mass., and from time to time during the Exposition additional consignments arrived. These fish were collected under more favorable conditions, as the Commission operates at that point several pound nets for the use of the Biological Laboratory, besides making collections with seines and other suitable appliances.

The salt-water display embraced the following species from the Atlantic coast:

Blue-fish, bur-fish, striped mullet, sea bass, white perch, sea raven, sea robin, dog-fish, sculpin, cod, hake, croaker, crevalle, cunner, pig-fish, pin-fish, pipe-fish, remora, rudder-fish, sand-dabs, scup, shark, skate, summer skate, squeteague, lane snapper, spot, star-fish, sticklebacks, stingray, swell-fish, tautog, toad-fish, tomcod, sand dollars, variegated minnows, short minnows, striped minnows, lump-fish, sheepshead, common eel, conger eel, file-fish, sea horse, summer flounder, spotted flounder, winter flounder, hog-choker, thread-fish, killi-fish, king-fish, menhaden, blue crab, green crab, lady crab, hermit crab, king crab, spider crab, horseshoe crab, conch, lobster, sea cucumber, sea anemone, and diamond-back terrapin.

From Bermuda 21 specimens were shown, representing 6 species, as follows:

Margate-fish, lane snapper, blue tang, blue angel, squirrel-fish, and red hind.

The following list shows the fresh-water fishes exhibited:

Atlantic salmon, landlocked salmon, quinnat salmon, rainbow trout, steelhead trout, black-spotted trout, Loch Leven trout, brown trout, Scotch sea trout, brook trout, albino brook trout, aureolus trout, hybrid trout, lake trout, Canadian red trout, Dublin trout, white-fish, lake herring, grayling, striped bass, shad and gizzard shad, large-mouthed black bass, small-mouthed black bass, rock bass, Warmouth bass, strawberry bass, white bass, yellow bass, crappie, burbot, yellow perch, pike, sauger, pike perch, pickerel, muskellunge, sun-fish, blue sun-fish, sturgeon, lake sturgeon, buffalo-fish, lake carp, leather carp, scale carp, channel cat-fish, spotted cat-fish, spoon-bill cat-fish, bullhead (cat-fish), grass pike, ling, shiners, common sucker, chub sucker, red drum, dace, dog-fish, eel, fresh-water drum, gar pike, golden ide, golden tench, green tench, gold-fish, lamprey, redhorse, mud puppies, lawyers, quailbacks, soft-shell turtle, snapping turtle, red-bellied terrapin.

The exhibit of fresh-water fishes, taken as a whole, far surpassed any exhibit of this character made at previous expositions, or in fact at any permanent aquaria in this country, during the summer months.

Some difficulty was experienced during the heated term in keeping white-fish, lake herring, muskellunge, suckers, and small-mouthed black bass, but through the courtesy of Hon. C. H. Babcock, of the New York Fish Commission, supplies of the small-mouthed black bass and muskellunge were sent from time to time to the aquarium to supply the losses from various causes.

Particular attention is called to the display of Salmonidæ which was maintained throughout the term of the Exposition on a scale never previously attempted in the United States.

Besides drawing on the stations of the Fish Commission for supplies of fresh-water fish, arrangements were made with the New York and Vermont State fish commissions for collections of game fish indigenous to those States.

One of the most attractive features of the aquarium was the large circular pool in the center of the building in which were displayed four specimens of the harbor seal. Two of these were loaned by the Zoological Park in Washington under the authority of the Secretary of the Smithsonian Institution. The other two were captured off the coast of Maine by the crew of the U. S. Fish Commission schooner *Grampus* after a pursuit which lasted several days and nights. These two specimens were pups which had just been weaned, and it was some time before they could be taught to take solid food. It was a matter of regret that one of the old seals was lost early in the season and both of the pups died during the last week of the Exposition. The food of the seals consisted largely of live fish captured in the lagoons and neighboring river and lake, although at times fish were purchased in the markets for them. They consumed about 3½ pounds per day each, though it is believed that they would eat from 10 to 15 pounds each; in fact there seemed to be no limit to their capacity, and fish were never abundant enough to thoroughly test, for any length of time, the question as to what a large seal would consume.

The cause of the death of the seals can not be stated definitely, but it was noted that they were taken sick after sudden changes in the temperature, and it is understood that this has been observed before. For no apparent reason they would stop eating for a few days; then they would commence to eat voraciously, but would lose flesh and develop a hump in the back. Every effort was made to remedy the trouble by a change of diet and by administering large doses of oil recommended by persons accustomed to the care of such animals. At the close of the Exposition the remaining seal was in excellent condition and was transferred to Charleston, S. C., where it was placed on exhibit in a salt-water tank.

In the pool with the seals was an 8-foot sturgeon, and although it apparently took no food and was subjected to constant annoyance by the seals, it lived until late in September. It is not known whether

the seals attacked the sturgeon for the purpose of eating it or simply in a playful manner, but its fins and tail showed evidences of the teeth of the seals from time to time during its captivity.

FOOD.

The food of the fresh-water fishes consisted largely of round beefsteak and liver chopped in various sizes to meet the requirements of the fish. In addition to this, when possible, large supplies of minnows and other small fishes were provided from the neighboring waters. This not only gives the fish a desirable change of diet, but it is almost impossible to teach the black bass and crappie to take liver and steak, which naturally results in the loss of large numbers. As but few of the salt-water fishes will take liver or steak, clams, oysters, fiddler crabs, and other material of this character were provided.

DISEASES.

The aquarial exhibit at Buffalo had much difficulty with fungus. The waters of Lake Erie appear to be well supplied with the spores of the fresh-water *Saprolegnia*. This vegetable parasite is an enemy which fish-culturists constantly encounter more or less. At Buffalo its attacks were unusually persistent, and constant attention was required to keep it within bounds.

The time-honored remedy for fungus is common salt, which was early adopted in fish-cultural work and has served with reasonable efficacy in preventing the parasite from gaining a foothold, but which is not particularly rapid and energetic in its action, and requires constant use in large amounts, involving considerable labor, care, and attention. In the endeavor to find a better remedy, potassium permanganate was selected for a trial, from its reported successful use in England when introduced constantly or for a considerable time into the water. This method was objectionable in the aquaria on account of the color imparted to the water, and was impracticable for other reasons also, the fish being able to endure only a short time. The permanganate is a powerful disinfectant and it proved to be readily fatal to the vegetative filaments of the fungus when freely exposed to the action of a dilution as small as 0.05 per cent for one minute. Trout will usually survive this treatment, and the filaments hanging from the body are killed. But this does not end the matter, for a ring of fresh growth is soon seen surrounding the original patch of fungus, which is not superficially attached, but vegetates into the skin itself and is protected by it and by the slime which covers the fish from head to tail. To reach this with a solution of any active substance and leave the fish uninjured is a difficult matter. The fish will not endure a material increase in the strength of the solution or the time of exposure, and there is no safe margin between a strength which is

SOUTH PAVILION OF GOVERNMENT BUILDING OCCUPIED BY FISHERIES EXHIBIT.

fatal to the fungus and one which is harmless to the fish. The permanganate can not be applied as a radical cure. Its regular and constant use held the fungus attacks in check, but this is accomplished by salt, which also has certain advantages in application.

Formalin was tried in weak solutions in much the same way as the permanganate and with substantially the same result, though it has advantages over the latter in greater safety for the fish. A chief objection to either of these substances, or any powerful agent requiring careful dilution and a short exposure to avoid killing the fish, is that more or less handling can not be avoided. On the other hand, the salt may be applied directly to the aquarium, where it passes slowly into solution and the fish can find different degrees of concentration. Though regular and constantly repeated applications are necessary, not much handling or transferring is required. On the whole, common salt is still the best remedy for the fungus trouble, which, under the conditions existing at Buffalo, can only be kept under control by constant attention.

Filtration would be an efficient and radical means of removing the fungus, and would probably prevent the attacks, though the possibility would still remain of spores brought by the fishes themselves. The sand filter does not remove these, and the quantity of water used is too large for any form of earthenware filtration. There were some minor attacks of external animal parasites which did not give continuous or very great trouble. The salt treatment aided in checking these, and formalin dilutions are probably also valuable in such cases, but have not been well tried, as the attacks were only occasional. However, it may be said that when all the conditions which must be complied with are considered, none of the substances used can be said to possess decided advantages over salt, whether for fungus or for exterior animal parasites. Other agents are more active and more fatal to the enemies of the fish, but none combines with parasiticidal powers the necessary qualities of cheapness, applicability, and safety to such a degree as common salt.

METHODS AND STATISTICS.

The fisheries of the United States represent an investment of about $60,000,000, giving employment to 200,000 persons, and are worth to the fishermen annually $50,000,000 in round numbers. While the bulk of the fisheries is carried on along the Atlantic and Pacific coasts, over $6,000,000 are invested in the fisheries of the Great Lakes, yielding to the fishermen $2,600,000 annually and employing 9,600 persons.

Fish and other water animals form an important factor in the food supply of the country when sold fresh, salted, or dried, and although modern methods have rendered it possible to preserve them fresh for considerable periods, it is not practicable to show them at expositions unless very extensive refrigerator systems are provided. Under fishery

products there was a very comprehensive display of fishes, oysters, lobsters, clams, turtles, shrimps, etc., preserved by canning in various ways, and by smoking, pickling, and salting.

The fresh-fish industries were illustrated by casts and engravings of the principal food-fishes and by pictures showing the manner of their capture. A series of shells of salt and fresh water mollusks commonly used for food or bait and a comprehensive collection of edible crustaceans preserved and mounted were also exhibited. The secondary products of the fisheries, also of considerable and increasing value, were illustrated as completely as possible. The principal of these are glues, fertilizers, oils, and isinglass.

From the skins of cusk, cod, and other fishes a superior glue is manufactured. These skins were formerly thrown away as waste, but now, after they have been cooked and the glue extracted, they are again used in the manufacture of an excellent fertilizer. Fertilizer is also produced from the waste in canning various other species and from the residuum of fish oil. The best and most extensively manufactured fish fertilizer is made from the menhaden, which is comparatively valueless as food and is found in great quantities all along the Atlantic coast. Isinglass is made from the "sounds" or air bladders of certain fishes like the cod, hake, and squeteague. These industries were illustrated by 24 samples of fertilizers and 25 samples of glue and isinglass. Nearly 60 different samples of oils, valuable for medicinal or mechanical purposes and obtained from fishes, were shown. The best-known and most extensively used are cod-liver, whale, sperm, and menhaden oils, but many others are particularly adapted for special uses, for which they are superior to other animal and mineral oils.

Sponges, although taken in the waters of only one State (Florida), are objects of an important fishery. The economic species were represented by a series of dried specimens of different grades and sizes.

Ivory, bone, and shell are among the products of the fisheries used to a certain extent in the arts and industries, and there were shown examples of walrus and narwhal tusks, sperm-whale teeth, baleen or whalebone, both crude and prepared for use, and the well-known tortoise shell, in the form of shells, rough and polished, of the hawksbill tortoise-shell turtle.

The shells of mollusks are employed for various purposes. A comparatively new use to which the shells of our fresh-water mussels have been put is in the manufacture of pearl buttons. This business, while only established a few years ago, has attained large proportions in the Mississippi basin. A full series of the shells utilized in button-making was shown, together with buttons in various stages of manufacture. The mollusks yielding shells suitable for buttons also produce very beautiful and valuable pearls, examples of which were exhibited.

The skins of water animals and some fishes are now largely utilized in the manufacture of leather goods of all kinds, and their use could

probably be extended. Alligator leather is familiar to all, but the seal, walrus, and sea-lion skins furnish particularly fine leathers which are susceptible of being worked to a high degree of pliability, dyed in a great variety of colors, and, like alligator leather and the skins of some water snakes, are used for making bags, purses, cases, pocket-books, belts, picture frames, etc. A number of samples of these leathers were shown and included the skins as they appear when first tanned and the leathers dressed and dyed for different purposes. The skins of several species of rays and of the dog-fish, gar pike, whale, manatee, and beaver were exhibited. The former are used by the Japanese for covering sword hilts and for other ornamental purposes, and, as well as the others, to some extent in this country in manufacturing picture frames, fancy articles, and other special purposes, though more coarse, brittle, and harder to work than the leathers first mentioned.

The fisheries supply valuable articles of wearing apparel in the form of furs, which were shown in their natural state and "plucked and dyed" ready for manufacture.

Large numbers of fur-seal skins are still obtained annually from the seal fisheries controlled by the United States on the Pribilof Islands in Alaska. These are considered the best and are commercially known as Alaska seal. Nearly all seal skins are dressed and dyed in Europe and returned to this country in a finished state ready to be made into garments. The sea otter found in Alaska furnishes the most valuable fur and is comparatively rare. It is used mainly as a trimming for coats and garments, and, as it has naturally a peculiar delicate silvery appearance, it is not dyed. Other fur-bearing aquatic animals taken in various parts of the United States, the furs of which are used, are fresh-water otter, beaver, and muskrat, an enormous number of the skins of the latter being taken annually. A coarse fur, from which are manufactured robes, cheap gloves, etc., is obtained from the common hair seal found along the Atlantic coast.

The vessel fisheries of the Atlantic and Pacific oceans and the Gulf of Mexico were illustrated by models of modern types of fishing vessels, particular attention being paid to those engaged in the Grand Bank cod fishing, the mackerel fishery, and the fresh-market fishery of Gloucester and Boston, Mass. The various types of pound nets, seines, trawls, hand lines, etc., used in the commercial fisheries were illustrated by models and by full-sized specimens where space permitted, together with dredges, tongs, and other articles used for taking oysters, scallops, clams, turtles, and sponges. There was also displayed a complete outfit of tackle and accessories used by anglers for sea fishing, bait fishing, trolling, fly fishing for trout, and salmon fishing, embracing hundreds of full-sized articles handsomely mounted.

One of the most interesting exhibits consisted of a collection of the various types of swivel guns, shoulder guns, rocket guns, harpoons,

lances, and other implements that have been used for the capture and handling of whales by the fishermen of this country. Brief descriptions of these are given on pages 334–337.

In addition to illustrating the work of the Commission by means of drawings, paintings, and photographs, arrangements were made with the American Mutoscope and Biograph Company, of New York, to utilize the mutoscopes. A very interesting exhibit was furnished, the phases of the fisheries shown being as follows:

Catching cod. Kittery Point, Me.
Taking and fertilizing the eggs of the cod. Kittery Point, Me.
Lifting a lobster pot. Kittery Point, Me.
Landing a haul of shad. Avoca, N. C.
Boating a shad seine. Avoca, N. C.
Angling for large-mouth black bass. Occoquan, Va.
Capt. Paul Boynton feeding sea lions. Coney Island.
View of Fulton Market, New York, on a busy day.
Angling for large-mouth black bass. Muskoka lakes, Ontario, on line of Grand Trunk Railroad.
Unloading a halibut vessel. Gloucester, Mass.
Unloading a cod vessel. Tee Wharf, Boston.

The scenes shown in the mutoscope are obtained by making a series of photographs of the moving objects on a long band of celluloid film at the rate of 1,800 pictures per minute. The time interval between the successive pictures is thus only the thirteenth part of a second.

Photographic prints are then made from a strip of negative pictures, and these prints are arranged in regular order around a cylinder. When the cylinder is revolved the cards are allowed to snap forward one after another, thus presenting the photographs to the eye in the order and at the same rate of speed at which they were originally taken. The velocity is so great that the eye does not appreciate the change from one picture to another, and the observer seems to be looking at one picture, in which the objects move as did the original. By this process any moving scene may be faithfully reproduced. The rapid flight of an express train, the movements of a watch, the maneuvers of a war vessel, and the movements of an insect are scenes which may be reproduced and which illustrate the possibilities of the art

COURTESIES RENDERED TO THE COMMISSION.

From the U. S. National Museum were obtained numerous specimens of crustacea and economic mollusks, besides models of vessels, and the historical collection of swivel guns, rockets, lances, etc., used in the whale fishery. The officials of the Museum cooperated most heartily with the Commission in all matters.

The Commission is under obligations to Mr. Howard Page, 26 Broadway, New York, for the loan of three tank cars belonging to the Union Tank Line Company, used in transporting salt water from Woods Hole, Mass., to Buffalo.

The superintendent of the New York Central Railroad, Mr. J. P. Bradfield, rendered material assistance in transferring, free of charge,

all Fish Commission cars from the union depot to the Exposition grounds, placing at our disposal a special engine, so that there was no delay in the delivery of the fish after they reached the city.

To the Michigan Central Railroad, through Mr. W. H. Underwood, the general eastern passenger agent, the Commission is indebted for the transportation of one of its cars from Buffalo to Chicago and return, enabling it to bring, free of charge, a load of fishes from the Mississippi River region.

The cordial cooperation of the Director-General of the Exposition, Mr. Buchanan; the director of works, Mr. Newcomb Carlton; and the superintendent of electricity, Mr. Henry Rustin, rendered possible the material increase of the aquarial display, both water and electricity being furnished free of cost and every assistance in other directions being freely given.

The New York State fish, game, and forest commission, through the State fish-culturist, Mr. A. N. Cheney, and Mr. C. H. Babcock, rendered material assistance throughout the term of the Exposition in supplying specimens of live fish.

To the Minnesota State fish commission thanks are due for the loan of a number of albino brook trout, which proved a considerable source of attraction.

The Vermont fish commission, through Mr. John W. Titcomb, chairman of the State commission, rendered material aid in furnishing the fishes of Vermont and a number of specimens of red trout from the Red Lakes of Canada.

To Col. J. E. Jones, superintendent of the New York Aquarium, credit is due for the display of Bermuda fishes.

In the preparation of models of apparatus, showing the various kinds of traps, pounds, and seines used in the commercial fishing on the Great Lakes and the Atlantic coast, the American Net and Twine Company, of Boston, rendered material assistance, also loaning a large purse seine, which was used for decorative purposes.

To Abbey & Imbrie, of New York, the Commission is indebted for the loan of a fine display of angling tackle, including miscellaneous supplies of all kinds used by anglers.

The Martin Novelty Company, of Ilion, N. Y., exhibited the automatic reels which they manufacture, showing not only the complete reels, but the method of construction by means of detached parts.

To Mr. J. K. Cheney, of Tarpon Springs, Fla., the Commission is indebted for a complete exhibit of sponges.

E. Brown & Bro., of New York, contributed from time to time supplies of Blue Point and other oysters for display in the aquarium.

To C. C. Shayne, of New York, the Commission is indebted for the loan of skins of water fur-bearing animals illustrating the various stages of preparation.

The Boepple Button Company, of Muscatine, Iowa, rendered assistance in collecting material illustrating the pearl-button industry of the Mississippi Valley.

Tiffany & Co., of New York, made an exhibit of pearls and pearl-bearing shells, illustrating the pearl industry of the United States.

The Fishing Gazette, of New York, exhibited a full set of its publications.

Hon. Nat Cohen, of Urbana, Ill., loaned a mounted and stuffed black bass, and Dr. S. P. Bartlett, of Quincy, Ill., a mounted and stuffed specimen of a muskellunge.

To Hon. F. Gourdeau, deputy minister of marine and fisheries, Ottawa, Canada, acknowledgments are due for permission to collect fishes in Canadian waters during the term of the Exposition.

PERSONNEL.

In the preparation of the U. S. Fish Commission exhibit the representative had associated with him as collaborators the following employees of the Commission:

Mr. George A. Schneider, draftsman, to whose skill and taste the beautiful design of the aquarium is due. Mr. Schneider also superintended its construction and assisted materially in the installation and arrangement of the exhibits.

Mr. I. H. Dunlap, chief clerk, under whose direction the systematic exhibit of the products of the fisheries was brought together and installed. This exhibit, though small, was probably the most complete ever made by the Government in the United States.

Dr. H. F. Moore prepared and installed the exhibit illustrating the work of the Division of Scientific Inquiry.

Dr. Hugh M. Smith secured and arranged the collection of Florida sponges and the exhibit illustrating the pearl-button industry.

Mr. H. von Bayer designed the model of the improved Cail fishway.

Messrs. C. H. Townsend, E. E. Hahn, E. F. Locke, F. F. Dimick, C. W. Scudder, C. G. Corliss, and J. F. Ellis rendered material assistance in collecting and preparing boat models, fishing apparatus, charts and photographs, illustrating the offshore fisheries of New England.

Mr. R. J. Conway installed the machinery used and was superintendent of the aquarium throughout the Exposition, and in the absence of the representative was in charge of the entire exhibit. Much of the success attained in the maintenance of the aquarium was due to his untiring energy, industry, and ingenuity.

Mr. M. C. Marsh, pathologist of the Fish Commission, rendered valuable services in connection with the treatment of fish diseases and prepared the matter on that subject in this report.

Mr. W. P. Sauerhoff and Mr. W. E. Morgan had charge of the general preparation, packing, installation, and maintenance of the fish-

VIEW TAKEN FROM GALLERY AT NORTH DOOR SHOWING SCIENTIFIC INQUIRY SECTION AND SWORDFISH EXHIBIT.

cultural and other exhibits, Mr. Sauerhoff superintending all of the fish-cultural work at the Exposition.

Mr. L. H. Harron, while in charge of repairs to the aquarium at Woods Hole, made several collections of salt-water fishes for the exhibit. These fish reached Buffalo in excellent condition, and were held with comparatively no losses until the close of the Exposition, illustrating clearly the necessity for employing only trained men in the collection of fishes for a permanent aquaria. He also made a fine collection of striped bass on the Potomac River early in the season for the same purpose.

Miss E. W. Lamon, as stenographer and bookkeeper, gave very efficient aid.

FINANCIAL STATEMENT.

The following statement shows the expenditures under various headings incurred in the preparation, installation, and maintenance and return of the exhibit. The $40,000 allotted was reduced by the transfer of $1,568.63 to the committee charged with the preparation of a colonial exhibit and $1,000 was transferred to the War Department, leaving a balance of $37,431.37 available. The total expenditures to date, including the known outstanding liabilities, amount to $37,141.28, leaving a balance of $290.09, but expenses still to be incurred in the returning and unpacking of the exhibits now in Charleston will probably use up this amount.

Services	$6,672.89
Travel and subsistence	4,713.17
Freight	1,361.29
Construction of aquarium	11,990.39
Maintenance of aquarium	3,426.74
Exhibition cases	3,251.04
Exhibits	4,583.33
Packing and installation	766.16
Miscellaneous and office	376.42
Total	37,141.28

In explanation of the items for services and travel, it should be stated that 75 per cent of the services are chargeable to the maintenance of the aquarium and 50 per cent of the item for travel and subsistence, which would make the total cost of the aquarium $22,778.38.

RETURN AND DISPOSITION OF EXHIBITS.

At the close of the Exposition, on November 3, under the direction of Commissioner George M. Bowers, the aquarium and other exhibits were transferred to Charleston, S. C., for the use of the South Carolina Interstate and West Indian Exposition, at the conclusion of which they will be sent to Washington and the loan exhibits will be returned to the Museum and other sources from whence they were obtained.

CATALOGUE.

PORTRAITS OF THE COMMISSIONERS.

SPENCER F. BAIRD, Commissioner, 1871–1887.
G. BROWN GOODE, Commissioner, 1887–88.
MARSHALL MCDONALD, Commissioner, 1888–1895.
J. J. BRICE, Commissioner, 1896–1898.
GEORGE M. BOWERS, Commissioner, 1898 to the present time.

PUBLICATIONS.

Reports of U. S. Fish Commission from 1871 to 1900.
Bulletins, U. S. Fish Commission.
Fishery Industries of the United States, 5 volumes, by G. Brown Goode and associates.
Fishes of North and Middle America, 4 volumes.

DIVISION OF SCIENTIFIC INQUIRY.

VESSELS AND APPARATUS FOR DEEP-SEA, PELAGIC, AND SHORE INVESTIGATIONS.

Model of the Albatross:

The steamer *Albatross* was built expressly for marine exploration, and intended especially for investigating the offshore fisheries and fishing-grounds of the United States. It is an iron twin-screw steamer, and was built in 1882 by the Pusey & Jones Company, of Wilmington, Del.

General dimensions: Length, over all, 234 feet; at 12-foot water line, 200 feet; breadth of beam, 27 feet 6 inches; displacement, on 12-foot draft, 1,000 tons; registered tonnage, net, 400 tons.

The deck house is 83 feet in length, 13 feet 6 inches wide, and 7 feet 3 inches from deck to deck. It is built of iron from the funnels aft, and sheathed with wood inside and out, with iron storm doors, but from the funnel forward it is of wood. Beginning aft in the iron house, the following apartments have been set off, viz., first, entrance to wardroom stairway; second, upper engine room; third, galley; fourth, steam-drum room.

In the wooden part: first, two staterooms for civilian scientific staff; second, upper laboratory, 14 feet in length, the width of the house and lighted in daytime by two windows and a door on each side and a skylight overhead; this room contains a central work-table, three hinged tables, a sink with alcohol and water tanks attached, and wall cases for books and apparatus; third, chart room, the width of the house, 8 feet 6 inches in length, containing chart table, locker for charts, book-shelves, berth, sofa, etc.; fourth, two staterooms at forward end of deck house. The pilot house is over the forward end of the deck house.

Abaft the steerage, but separated from it by an iron bulkhead, is the lower laboratory, immediately below the upper laboratory, through which it is entered. This room extends quite across the ship, is 20 feet long, 7 feet 10 inches in height between decks, and is lighted in daytime by six 8-inch side lights, two 12-inch deck lights, and the hatch at the head of the stairway. Ample storage cases and lockers are provided for alcohol jars and specimens; long worktables are placed on each side; in one corner is the photographic dark room, with a large lead-lined sink with running water; in another is the medical dispensary, and across the aft end is a storage room. Below this room is the main scientific storeroom, a closed iron box capable of being isolated from the rest of the ship and filled with steam at short notice in case of fire. Here are stored alcohol, specimens, nets, etc., for which lockers have been provided.

Model of the Fish Hawk:

The steamer *Fish Hawk* is a twin-screw propeller of 205.71 tons measurement; is rigged as a fore-and-aft schooner, with pole topmasts, and constructed for the combined purpose of fish-hatching and exploration. She was designed by Charles W.

Copeland, and built in 1880 by Pusey & Jones, of Wilmington, Del. The work of fish-hatching necessitates her entering, at times, the shallow waters of rivers, bays, and sounds along the coast, and she was therefore given a light draft, which unsuits her for long trips at sea. The hull below the main deck is of iron, built on Lloyd's rules for vessels of her class, and sheathed with yellow pine 2½ to 3 inches thick. Above the main deck the structure is of wood. The hurricane deck extends from stem to stern and from side to side, on which are located the pilot house, captain's quarters, and laboratory.

General dimensions: Length over all, 156 feet 6 inches; breadth of beam, 27 feet; mean draft, 6 feet 5½ inches.

Main deck: The forecastle extends 31 feet aft from stem, and is succeeded by the main or hatching deck, which is 47 feet long. The latter has on each side a gangway port abreast of the foremast 6 feet wide and extending from deck to deck, and is raised about 9 inches above it. On the hatches are placed the donkey pump and distributing tanks for the hatching apparatus, which is arranged around it. While engaged in dredging, the hatching apparatus, excepting the pump, is entirely removed from this deck, and it becomes the working quarters of the naturalists. The beam trawls and dredges, which are manipulated from the upper deck, are passed in at the gangway port on the starboard side, their contents emptied into sieves and washed, and then transferred to swinging tables, where they are sorted, examined, and studied. The arrangements for this class of work are very convenient and the working space ample. With all the ports open on both sides, the deck receives an abundance of light. The donkey pump is used for washing the materials emptied into the sieves.

The vessel is employed about six months in the year in fish-culture work on the Atlantic coast. During the fiscal year 1901 she was engaged in scientific work in connection with the Woods Hole laboratory, a survey of the oyster beds of Pamlico Sound, a survey of the sponge grounds of the west coast of Florida, and in hatching shad on the Delaware River.

Tanner sounding machine and instruments for deep-sea physical research:

The Tanner sounding machine is used in depths not exceeding 500 fathoms (3,000 feet). For greater depths the Sigsbee machine, which reels in sounding wire by steam power, is used. On both machines steel piano wire is used in place of the hemp sounding lines formerly employed, its advantages being strength, lightness, and small bulk. With it heavier sinkers can be employed to give an up-and-down trend, and its smaller surface per linear foot renders it less liable than the hemp lines to be diverted from the vertical by currents. A 65-pound shot on the sounding cylinder is automatically detached when the bottom is reached, in order to lessen the tension when reeling in. The sounding cylinder brings up a specimen from the bottom, the water cup takes a sample of water within a few feet of the bottom, and the deep-sea thermometer automatically records the bottom temperature.

With the Sigsbee machine the *Albatross* recently found a depth of 4,813 fathoms (about 5½ miles), one of the deepest oceanic depressions in the world, about 100 miles southeast of Guam. The highest mountain in North America would be covered by nearly 2 miles of water if placed in this depression.

Salinometers:

Used in determining the salinity or density of sea water. Made in sets of three, which together have a range between fresh water and the greatest density found in the sea.

Salinometer cup:

Used to hold the water being tested by the salinometer. It is provided with a thermometer, which furnishes data used in correcting the readings to a standard temperature of 15° C.

Open thermometer:

Used in determining temperature of air and water.

Seven-foot beam trawl:

A beam trawl was displayed, fully rigged and arranged in the position which it assumes when in use. This is the most efficient piece of apparatus employed in collecting specimens from the bottom of the sea, in either shallow or deep water. The one exhibited was the smallest used on the vessels of the U. S. Fish Commission, measuring 7 feet across the mouth; the largest form in general use is 11 feet across the mouth, and the other dimensions are correspondingly larger. The frame is composed of two iron runners connected at the top by a transverse beam of iron piping, to which the upper part of it is secured. The net consists of an outer bag

about 22 feet long, having the lower side of its mouth heavily loaded with lead sinkers to insure its dragging closely on the bottom. Immediately back of the mouth it is provided with an internal, funnel-shaped apron, to prevent the escape of animals which have once entered, and for 5 feet at the bottom there is also an inner pocket of small-meshed netting to hold the smaller specimens. A thick-walled spherical glass float is attached to the upper side of the net near the mouth, so as to hold it open when immersed. The lower end or tail of the net is closed by a secure lashing, which is removed after each haul for the discharge of the specimens into table sieves on the deck of the vessel, where they are washed, sorted, and preserved for future study. The trawl is dragged by a steel rope which will bear a strain of 7 tons, rigged to a heavy bottom attached to the foremast. The trawl is lowered and hauled in by steam power. With a net in general design similar to the one exhibited the *Albatross* has obtained specimens in water over 4¾ miles deep.

Tangle bars:

Used to collect specimens where the bottom is so foul or rocky that the beam trawl, or any other form of net, would be torn or otherwise seriously injured. It is by no means as efficient as the trawl, but on rocky or coral bottom it is practically the only appliance which can be used, and it frequently catches numerous specimens of star-fishes, sea urchins, corals, crabs, shrimp, fishes, and other animals which become entangled in the mops. The bow at the angle of the bars is made of tempered steel, so that the legs will close up on one another like a pair of dividers if the frame becomes fouled in the rocks. The tangles are dragged over the bottom by the wire used for trawling.

Chester rake-dredge:

For use from large vessels in collecting burrowing species of fish, mollusks, worms, etc., on hard mud or sand bottom.

Large boat-dredge:

Used for collecting specimens from the bottom.

Small boat-dredge:

Used for collecting specimens from the bottom.

Surface tow-net (3-foot):

Used for collecting surface-swimming and floating plants and animals. The outer bag of netting serves as a support to the lining of cheesecloth used to retain the more minute organisms. The funnel prevents the escape of active species of shrimps and fishes. After a towing is made the tail lashing is removed and the specimens washed into a basin of water, from which they are picked out and transferred to preservatives. The net is usually towed at a speed of about 2 knots per hour.

Surface tow-net (silk gauze):

Used for catching small and microscopic organisms at the surface.

Tanner intermediate tow-net, for taking specimens at known depths:

This net is lowered vertically to the required depth and towed for a definite time. A weight or messenger is then sent down the wire, which reverses the tumbler, casts off the bridles, and allows the weights on the legs of the frame to exert a strong pull on the drawstring and securely close the bottom half of the net.

Townsend intermediate tow-net:

Used like the Tanner net. The ring is hinged and the two halves are closed on one another by a device actuated by a messenger slid down the rope.

Twenty-five-foot Baird seine:

This is a type of seine especially devised and used for collecting fishes and, incidentally, other water animals. It is rigged with floats and leads like ordinary seines, but has as its distinctive features a very fine mesh and a large bag in the center into which the catch gravitates, and can be most conveniently overhauled. Two persons are required to operate it, and it may be set from a rowboat or by wading. The standard lengths of collecting seines used by the Commission are 15, 25, 45, 75, and 120 feet.

Smith rake dredge:

For use from a small boat in collecting burrowing species of clams, worms, etc., on hard mud or sand bottom.

VIEW SHOWING BEAM TRAWL IN POSITION AND OTHER SCIENTIFIC APPARATUS.

Gill nets:

Gill nets of various sizes and types, similar to those employed in the commercial fisheries, are used in collecting and determining the nature of the fish life in waters in which other kinds of apparatus can not be so conveniently or effectively employed.

Dip nets, scrape nets, etc.:

Various forms of hand nets, intended to be used from boats, wharves, or shores, are required in collecting small fishes and invertebrates that are swimming in the water, resting on the bottom, or attached to piling, rocks, etc.

Collecting tank and chest:

For use in the field and in shipping collections the Commission has adopted a stout chest with handles and padlocks. The chest accommodates one 16-gallon tank, two 8-gallon tanks, or four 4-gallon tanks, made of sheet copper with tightly fitting screw tops.

Maps, Charts, and Illustrations.

Ten charts to illustrate the geographical distribution of the important food-fishes of the Great Lakes: Common pike, sauger, small-mouth black bass, large-mouth black bass, lake trout, sturgeon, lake herring, muskallunge, wall-eyed pike, common white-fish.

One frame of plates from U. S. Fish Commission publications illustrating the embryology of the common lobster.

One frame of plates reproduced from photographs of living fishes from publications of the U. S. Fish Commission.

Four frames of colored plates of fishes from publications of the U. S. Fish Commission.

Map of the United States showing location of scientific investigations made by the U. S. Fish Commission.

Economic Mollusca of the United States.

234. Flat razor-shell clam (*Siliqua patula*). Alaska to California. Used as food.
235. Razor-shell clam (*Ensis directus*). Atlantic coast. Used as bait.
236. Long clam, soft clam (*Mya arenaria*). Atlantic coast south to South Carolina. Used as food and bait.
237. *Platyodon cancellatus.* California.
238. Hen clam, surf clam (*Spisula similis*). Southeast coast United States. Used as food and bait.
239. Hen clam, surf clam (*Spisula solidissima*). Atlantic coast. Used as food and bait.
240. Alaska surf clam (*Spisula planulata*). Alaska.
241. Cuneate clam (*Gnathodon cuneatus*). Gulf coast of United States. Used as food.
242. Giant clam (*Tresus nuttalli*). Pacific coast. Used as food.
243. *Donax lævigata.* Pacific coast. Used in the manufacture of clam juice.
244. Round clam (*Saxidomus aratus*). California. Used as food.
245. Round clam (*Saxidomus nuttalli*). California. Used as food.
246. Hard clam; quahog (*Venus mercenaria*). Atlantic coast. Used as food and bait.
247. Florida quahog (*Venus mortoni*). Florida. Used as food and bait.
248. Hard clam (*Venus simillima*). California.
249. *Meretrix nimbosa.* Florida.
250. *Tivela crassateloides.* California.
251. California little-neck clam (*Tapes staminea*). California.
252. Deep-water clam (*Cyprina islandica*). Atlantic coast, south to New York. Occasionally used as food and bait.
253. California cockle (*Cardium corbis*). Pacific coast.
254. Florida cockle (*Cardium robustum*). Florida.
255. Bloody clam (*Arca pexata*). Massachusetts to Mexico. Occasionally used as bait.
256. Common mussel (*Mytilus edulis*). Atlantic, Gulf, and Pacific coasts and Europe. Used as food and bait.
257. California mussel (*Mytilus californicus*). Pacific coast. Used as food.
258. Horse mussel (*Modiolus modiolus*). Pacific coast; Atlantic coast south to New Jersey; Europe. Used as food and bait.
259. Ribbed mussel (*Modiolus plicatulus*). Maine to Georgia. Used as food and bait.
260. Giant scallop (*Pecten magellanicus*). Labrador to New Jersey. Used as food.
261. Pacific coast scallop (*Pecten caurinus*). Pacific coast. Used as food.
262. Common scallop (*Pecten irradians*). Atlantic coast.
263. Scallop (*Pecten ventricosus*). Pacific coast.

ECONOMIC CRUSTACEA OF THE UNITED STATES AND PORTO RICO.

264. Pacific edible crab (*Cancer magister*). Pacific coast. Used as food.
265. Alaska spider crab (*Lithodes camtschaticus*). Northern Pacific Ocean. Used as food.
266. *Lopholithodes mandtii*. Pacific coast. Used as food.
267. *Scyllarides æquinoctialis*. Porto Rico and West Indies. Used as food.
268. Deep-sea crab (*Geryon quinquedens*). Eastern coast of United States; 500 to 1,000 fathoms.
269. Stone crab (*Menippe mercenaria*). South Atlantic and Gulf coasts. Used as food.
270. Common edible crab; blue crab (*Callinectes sapidus*). Atlantic coast. Important as food.
271. Spider crab (*Lithodes maia*). North Atlantic coast.
272. *Lopholithodes foraminatus*. Atlantic coast. Used as food.
273. Kelp crab (*Epialtus productus*). British Columbia to southern California.
274. Horseshoe crab, king crab (*Limulus polyphemus*). Atlantic coast. Used as fertilizer and as food for swine. This has a limited use as food for man.
275. Lady crab (*Ovalipes ocellata*). Atlantic coast. Used as bait.
276. Sand crab (*Ocypode albicans*). Long Island to Brazil. Used as bait.
277. Rock crab (*Cancer irroratus*). Labrador to South Carolina. Used as bait and occasionally as food.
278. Jonah crab (*Cancer borealis*). Nova Scotia to New York. Used as bait and occasionally as food.
279. Mud crab (*Carcinides mænas*). Atlantic coast. Occasionally used as bait.
280. Oyster crab (*Pinnotheres ostreum*). Atlantic coast, considered a delicacy as food.
281. *Mithrax hispidus*. Gulf coast.
282. Spider crab (*Libinia emarginata*). Atlantic coast.
283. Box crab (*Calappa flammea*). Porto Rico. Used as food.
284. *Portunis spinimanus*. Porto Rico. Used as food.
285. River shrimp; "Camarone" (*Bithynis jamaicensis*). Southern United States and Porto Rico. Used as food.
286. *Carpilus corallinus*. Porto Rico. Used as food.
287. Terrestrial hermit crab (*Cœnobita diogenes*). Porto Rico. Used as food.
288. Hermit crab (*Petrochirus bahamensis*). Porto Rico. Used as food.
289. Land crab; "Juey" (*Cardisoma guanhumi*). Porto Rico. Used as food.
290. Coral crab (*Grapsus grapsus*). Porto Rico. Used as food.
291. Edible crab (*Callinectes bocourti*). Porto Rico. Used as food.
292. Hermit crab (*Pagurias insignis*). Porto Rico. Used as food.
293. Sand crab (*Ocypode albicans*). Long Island to Brazil. Used as bait.
294. River crab; "Boragina" (*Epilobocera sinuatifrons*). Porto Rico. Used as food.
295. Mangrove crab (*Goniopsis cruentata*). Porto Rico. Used as food.
296. Edible crab (*Callinectes danæ*). Porto Rico. Used as food.
297. Land crab (*Gecarcinus lateralis*). Porto Rico. Used as food.
298. Land crab (*Ucides cordatus*). Porto Rico. Used as food.
299. Hippa (*Emerita talpoida*). Atlantic coast. Used as bait.
300. Mantis shrimp (*Chloridella empusa*). Atlantic coast.
301. River shrimp (*Bithynis ohionis*). Southern United States and Porto Rico. Used as food.
301½. River shrimp; "Camarone" (*Xiphocaris elongata*). Porto Rico. Used as food.
302. Spiny lobster (*Panulirus interruptus*). Pacific coast. Used as food.
303. River shrimp; "Camarone" (*Bithynis acanthurus*). Porto Rico. Used as food.
304. River shrimp; "Camarone." Porto Rico. Used as food.
305. Southern shrimp; "Camarone marina" (*Penæus brasiliensis*). Gulf coast and Porto Rico. Important as food.
306. Common prawn (*Palæmonetes vulgaris*). Atlantic coast. Used as food and bait.
307. Common shrimp (*Crangon vulgaris*). Atlantic coast.

EASTERN OYSTERS ATTACHED TO VARIOUS OBJECTS.

308. Eastern oyster. Cluster attached to brick.
309. Eastern oyster. Growing from bowl of clay pipe.
310. Eastern oyster. Growing attached to and inside of bottle.
311. Eastern oyster. Young. Attached to piece of old wood.
312. Eastern oyster. Growing on earthen ink bottle.
313. Eastern oyster. Young. On rubber shoe.
314. Eastern oyster. On piece of petrified wood.
315. Eastern oyster. Growing on child's leather shoe.

316. Eastern oyster. Growing on twig of tree. In Florida some of the oysters, and in Porto Rico practically all of them, are found attached to the mangroves near the surface of the water.
317. Eastern oyster. Growing on palmetto pile.
318. Eastern oyster. Young. Growth or set on sheet of rubber, showing the density with which they sometimes attach themselves. The silver shells are "jingles" (*Anomia glaora*).
319. Eastern oyster. Growing on bark planted as cultch to furnish places of attachment.

PACIFIC OYSTERS.

320. Pacific oyster. Growing on shells of Eastern oyster. The native oyster sometimes kills the introduced species by this overgrowth.
321. Pacific oyster. Dense growth of young on shells of Eastern oysters.
322. Pacific oyster. Growing around edge of scallop shell.
323. Pacific oyster. Shoalwater Bay, Washington. These are regarded as the best oysters on the Pacific coast.
324. Pacific oyster. San Francisco Bay.
325. Pacific oyster. Port Townsend, Wash.
326. Rock oyster (*Hinnites giganteus*). California.

EUROPEAN OYSTERS FROM CULTIVATED BEDS.

327. European oyster. Esperig, Norway. About four months old.
328. European oyster. Esperig, Norway. About two years old.
329. European oyster. Esperig, Norway. About three years old.

EASTERN OYSTERS FROM PRINCIPAL BEDS OF ATLANTIC AND PACIFIC COASTS.

330. Hyannis, Mass.
331. Providence River, Rhode Island.
332. Greenwich, Conn. Old oyster from planted beds.
333. Greenwich, Conn. Old oyster from planted beds.
334. Shinnecock Bay, Long Island.
335. Blue Point, Long Island.
336. Saddle Rock, Long Island.
337. Rockaway, Long Island.
338. Tangier Sound, Maryland.
339. Chincoteague, Va. Some of the valves show inclusions of mud between layers of the shell.
340. York River, Va.
341. James River, Va.
342. Lynnhaven Bay, Va. Large specimen, showing inclusion of mud between layers of shell near the tip.
343. Beaufort, S. C. Cluster of young on old raccoon oyster.
344. Beaufort, S. C. Cluster of raccoon oysters from muddy tide floats.
345. Beaufort, S. C. Single oysters separated from clusters when young, showing great improvement in shape over those exhibited as No. 15.
346. Charleston, S. C. Planted oysters.
347. Troup Creek, Ga.
348. St. Georges Sound, Fla.
349. St. Andrews Bay, Fla.
350. Apalachicola Bay, Fla.
351. Silvias Bar, St. Georges Sound, Fla. Shows seaweed adherent to valves, characteristic of these beds.
352. Mobile Bay, Ala.
353. Mobile Bay, Ala. Large specimen.
354. Bay Jump, La. The thick shells are characteristic of these beds.
355. Jack Stout Bayou, La.
356. Cedar Bayou, Tex. "Texas saddlerocks."
357. San Francisco Bay, Cal. Eastern oysters transplanted from Atlantic coast when small.
358. San Francisco Bay, Cal. Eastern oysters. The offspring of transplanted stock.
359. Yaquina Bay, Oreg. Eastern oysters transplanted from Atlantic coast when small.

EASTERN OYSTER, GROWTH AND ENEMIES

360. "Jingle" cultch. Planted to catch young oysters.
361. Broken-stone cultch. Planted to catch young oysters.
362. Fresh-water clams. Used as cultch to catch young oysters.
363. Eastern oyster three or four weeks old on planted oyster shells. Long Island Sound.
364. Eastern oyster. Less than six weeks old, on planted oyster shells. Louisiana.
365. Eastern oyster. Two months old, on planted stone. Long Island Sound.
366. Eastern oyster. Less than one year old. South Carolina.
367. Eastern oyster. One year old. Hard bottom. Connecticut.
368. Eastern oyster. Two years old. Hard bottom. Connecticut.
369. Eastern oyster. Three years old. Hard bottom. Connecticut.
370. Eastern oyster. Four years old. Hard bottom. Connecticut.
371. Eastern oyster. Five years old. Hard bottom. Connecticut.
372. Eastern oyster. Six years old. Hard bottom. Connecticut.
373. Eastern oyster. One year old. Soft bottom. Connecticut.
374. Eastern oyster. Two years old. Soft bottom. Connecticut.
375. Eastern oyster. Three years old. Soft bottom. Connecticut.
376. Eastern oyster. Four years old. Soft bottom. Connecticut.
377. Eastern oyster. Five years old. Soft bottom. Connecticut.
378. Eastern oyster. Six years old. Soft bottom. Connecticut.
379. Eastern oyster. Sixteen years old. Soft bottom. Connecticut.
380. Eastern oyster. Shells corroded by boring sponge, showing on the inside face the new shell deposited by the oyster to cover up the perforations.
381. Shells overgrown with calcareous tubes of worm *Serpula*, which sometimes grow so densely as to kill or injure clusters of oysters by preventing their opening their shells.
382. Common starfish (*Asterias forbesii*). A very destructive enemy of the oyster in Long Island Sound.
383. Common starfish (*Asterias forbesii*). Position commonly assumed when feeding. It turns the stomach inside out and projects it through its mouth and around its food. When satisfied its stomach is returned to its proper place.
384. Common starfish. Taken in the act of feeding on oysters. The starfish wrenches upon the oyster by a long, steady pull, and then inserts its stomach between the valves as explained above and absorbs the contents.
385. Oyster drill. Very destructive to oysters on certain parts of the Atlantic coast. By means of a rasp-like tongue it drills a hole in the shell, through which it feeds on the soft parts of the oyster. It has unfortunately been introduced with Eastern oysters in San Francisco Bay.
386. Eastern oysters. Shells bored by drills.
387. Conch or "winkle" and egg cases (*Fulgur carica*). Oyster enemy. Not very destructive.
388. Conch or "winkle" and egg cases, (*Sycotypus canaliculatus*). Oyster enemy. Not very destructive.
389. Eastern oyster. Cluster to show how the oysters are crowded by barnacles and mussels.
390. Eastern oyster. Showing overgrowth of barnacles.

SPONGES.

Of the fishery products not used for food the sponges rank among the most important, being extensively employed for various purposes in all civilized and many barbarous countries. Florida is the only State on whose shores commercial sponges are found. They are there taken in water ranging from a few feet to 50 feet in depth, and occur in abundance throughout the Florida reefs and keys and on the western coast as far north as St. Marks. The annual value of the Florida sponge fishery is from $500,000 to $600,000, representing upward of 400,000 pounds of dry sponges.

When first taken from the water the meshes of the sponges are filled with a pulpy mass, and the external surface is covered with a skin perforated for the currents of water, on which the animal depends for its food and growth. Several natural sponges are shown, preserved in alcohol.

The kinds of sponges recognized in the local sponge fishery and trade are sheepswool, yellow, velvet, grass, and glove. The sheepswool, which is found among the Florida Keys and in the Gulf of Mexico, is the best grade of sponge, exceeding in value all others combined. It is used for a great variety of domestic and other purposes, and is the leading bath and toilet sponge. The average wholesale price per pound received by the fishermen is $2.50 to $2.75. The yellow sponge, of which the

most valuable grade comes from the Florida Keys, ranks next to the sheepswool in commercial importance. The average wholesale price is 60 cents to $1 per pound. It is widely used for household purposes, and by painters, calciminers, wood workers, and others for polishing and scraping. The velvet or boat sponge is of superior grade, with a very soft texture, and is employed for the same purposes as the sheepswool. It is not abundant, and brings about $1.25 a pound. The grass and glove sponges are very abundant, but, being of inferior quality, they are only sparingly used for the toilet. They are, however, extensively employed in livery stables, for applying enamel and stiffening to fabrics, for absorbing oil in condensing tanks, and for many other purposes. The glove sponges are worth only 15 cents a pound, and the grass 30 or 35 cents, wholesale.

The artificial bleaching of sponges is a common practice and improves their appearance, but unless very judiciously done is likely to impair their durability. Bleached sponges of all the standard grades are exhibited in the collection.

391. *Natural sponges from Florida:*

Showing their condition and appearance when first taken from the water. The meshes are filled with a pulpy mass, and the sponge is covered externally with a skin perforated for the entrance and escape of the water currents.

392. *Sheepswool sponges from Gulf of Mexico:*

The sheepswool is the best grade of sponge, and exceeds in value all other kinds combined. The best quality comes from the grounds off the northern part of the west coast of Florida. The present average wholesale price to the fishermen is about $2.75 per pound. This is the leading toilet sponge, and is also employed for many other domestic and special purposes.

393. *Sheepswool sponges from Florida Keys:*

The sheepswool is the best grade of sponge, and exceeds in value all other kinds combined. The present average wholesale price received by the fishermen is $2.50 per pound. This sponge is extensively used for a great variety of domestic and other purposes, and is the leading bath sponge.

394. *Glove sponges from Florida Keys:*

The cheapest grade of commercial sponge, valued at only 15 cents a pound wholesale. It has a limited use for domestic and other purposes.

395. *Grass sponges from Gulf of Mexico:*

A cheap sponge, reaching a large size, and growing in great abundance on parts of the Gulf coast; it is used for the toilet and for numerous domestic and other purposes. The average wholesale selling price to the fishermen is 35 cents per pound.

396. *Grass sponges from Florida Keys:*

This is a cheap grade of sponge growing in great abundance in Florida waters. It is sparingly used for the toilet, and is also employed in livery stables, in condensing tanks to take up oil, for applying enamel and stiffening to fabrics, and a large variety of other purposes. Average wholesale price to fishermen, 30 cents per pound.

397. *Wire or bastard sheepswool sponges from Florida Keys:*

A very coarse, stiff sponge of little commercial value and very limited usefulness.

398. *Velvet or boat sponges,* artificially bleached.

399. *Grass sponges,* artificially bleached.

400. *Glove sponges,* artificially bleached.

401. *Yellow sponges from Florida Keys:*

A valuable species, much used for domestic purposes and by woodworkers, painters, and other artisans. The average wholesale price when first landed from the sponge grounds is $1 per pound. The yellow sponges from the Florida Keys are superior to those from grounds in the Gulf of Mexico.

403. *Velvet or boat sponges from Florida Keys:*

A superior grade of sponge, with very soft texture. Valued at about $1.25 per pound, wholesale, at the local sponge markets. Used for toilet and other domestic purposes.

404. *Yellow sponges from Gulf of Mexico:*

An important species, extensively used for domestic purposes and for scraping and polishing woods and walls by painters, calciminers, woodworkers, etc. The average wholesale price is about 60 cents per pound to the fishermen.

405. *Yellow sponges* of various kinds, artificially bleached.

406. *Sheepswool sponges*, artificially bleached.

407. *Samples:*

Sponges in condition in which they are landed and sold by the fishermen, presented by Mr. John K. Cheney, Tarpon Springs, Fla.

Development of a Trout.

408. *Models illustrating the early stages of development of a trout:*

The fertilized egg is shown in model 1. The white portion represents the disk of protoplasm which by its growth and development gives rise to the embryo. The yellow portion, which is relatively large in the early stages, is the yolk, which serves as food and is gradually absorbed during the process of development. The first marked change is the formation of a furrow which divides the protoplasm into two masses or blastomeres, as shown in model 2. Each of these becomes divided by a cross furrow, producing 4 cells, as shown in model 3, and subsequent divisions give rise to 8, 16, 32, and eventually numerous cells, as shown in models 4–8. During the later stages of this process the protoplasmic matter has increased by the absorption of some of the yolk, which becomes thereby relatively and actually smaller. The mass of cells has become lens-shaped, its lower surface dipping somewhat into the yolk, as shown in models 9 and 10, which represent sections of about the stages shown in models 6 and 7, respectively.

The mass of cells which has before been uniform now becomes differentiated into two layers, and a cavity appears between the lower layer and the yolk. This is shown in models 11 and 12, where the layers are indicated by conventional colors. Soon after, a third layer appears between these two, as shown in model 13. These three layers give rise to all the tissues of the adult fish, in general terms, the outer giving rise to the outer skin, brain, and sense organs, the inner or lower layer to the lining of the alimentary canal and to parts of the related organs, and the middle layer to the bones, muscles, blood vessels, etc.

As the protoplasmic portion or blastodermic disk gradually extends over the yolk its edge becomes thickened and the body of the fish begins as a tongue-like growth inward from a part of this ring, gradually extending over the disk, as shown in models 14–21. The thickened folds shown in model 21, and several of its predecessors, represent the developing brain and spinal cord.

Subsequently the sense organs, alimentary canal, and other organs appear, the head and tail of the embryo grow free from the now inclosed dwindling yolk, and at the time of hatching the latter remains as a protuberant sac on the fish's belly, furnishing nourishment to the fry until such time as it is able to take food through its mouth.

Bacterial Exhibit.

409. *Cultures of bacteria which infest fishes or are found in the water:*

The exhibit of bacteria is designed to illustrate the Commission's work in a comparatively new field. Bacteria are of chief importance in human disease, and it was to be anticipated that they would play a corresponding part in lower forms. Some important affections of fishes have been traced to bacterial infection, and several of the cultures shown were made from the blood or tissues of diseased fishes. Notable among these is the bacillus of tuberculosis in fishes, from a European source, this disease not having yet appeared among fishes in this country. The principal pus cocci are also represented, among which the streptococcus is most important, causing the "oyster hand," familiar in oyster regions, and arising from wounds caused by "shucking" oysters or handling the shells.

A number of salt and fresh water bacteria are shown, including some handsome chromogens. Some of these are also frequently found associated with water. The phosphorescent organism exhibited produces phosphorescence in the sea, and will grow on cooked fish, producing a readily appreciable amount of light. The commoner water organisms may be frequently obtained from tissues or regions of fishes to which they have access.

A few cultures are included which have been grown from fishes to all appearances free from disease. These are bacilli and were obtained from the blood and from the peritoneal cavity of brook trout. They represent normal bacteriology of fishes, a new and little known field of rather uncertain significance, but suggestive and full of interest as indicating possible important relations to normal life processes.

The cultures, as exhibited, are not living, the growth having been killed and the medium upon which it rests hardened by formalin.

DIVISION OF FISH-CULTURE.

Apparatus for Transporting Eggs.

Clark white-fish-egg box:

Wooden case, with hinged door, containing twenty trays. This case is used chiefly for the transportation of the eggs of the white-fish and lake trout from field stations on the Great Lakes, and was designed by Mr. Frank N. Clark, of Northville, Mich. Eggs have frequently been held on these cases from fifteen to thirty days before they reached the hatchery, without suffering material loss.

Annin's egg-transportation box:

This apparatus consists of an outer case which contains a smaller one, surrounded by sawdust to prevent loss of eggs from sudden change of temperature. The inner case is provided with trays, with canton-flannel bottoms, for holding the eggs. There is a small ice chamber between the outer and inner boxes, and the bottom of the outer box is provided with wooden strips to prevent its coming in contact with the surface on which it rests, which would prevent drainage.

Devised by James Annin, jr., Caledonia, N. Y. Boxes of this patent have been used for sending eggs of trout to Europe.

Atkins's transportation box:

A wooden box containing three smaller boxes, in each of which 15,000 salmon eggs are placed upon layers of muslin. The space between the larger and smaller boxes is filled with moss to prevent an unhealthy change of temperature, and the layers of eggs are separated from each other by wet moss. Eggs packed in this way can be sent several thousand miles with very satisfactory results.

Devised by Charles G. Atkins, Bucksport, Me.

Seagle's egg-transportation box:

This apparatus consists of a wooden box, with hinged cover, 21 inches long, 19 inches wide, and 18½ inches high, containing 6 canton-flannel trays, 11½ inches by 9½ inches, on which the eggs are placed, packed in moss. A wooden hopper above the trays holds crushed ice, and the space around the trays is tightly packed with sphagnum moss. Eggs of the Salmonidæ are successfully transported long distances by means of this apparatus.

Devised by George A. Seagle, Wytheville, Va.

McDonald's egg-transportation crate:

A crate containing eighteen shallow trays or wooden frames, with wire-cloth bottoms, incased in canvas and secured by frames connected by leather straps. Length, 16 inches; height, 15 inches; width, 14 inches. This crate is used for transporting the eggs of the shad for a distance of 50 to 100 miles. The bottoms of the trays are covered with wet cloths, upon which the eggs are spread. Each tray holds from 10,000 to 15,000 shad eggs. When filled they are incased in the cloth cover, securely strapped together, and shipped by boat or rail to the hatchery. This apparatus marks the beginning of the dry transportation of shad eggs, and has been successfully used in the work of the U. S. Fish Commission since invented.

Invented by Marshall McDonald, 1881.

Apparatus for Transporting Fry.

Model of U. S. Fish Commission car No. 3 (scale of 1 inch to the foot):

This car was built in Wilmington, Del., by the Harlan & Hollingsworth Company in the month of November, 1897. Total length of frame, 60 feet; width of frame, 9 feet 6 inches; total length of car from ends of platforms, 67 feet 10 inches; height of car from top of rail to top of roof, 13 feet 10 inches. The frame of the car has a special bracing in order to allow the two large doors in the center of the car to extend from floor to roof. The trucks for the car were made by the Pullman Company, each of them having six 33-inch Allen paper wheels. The interior finish of the car is of light-color ash. In one end of the car is an office, and next to it an ice box—capacity of about 1½ tons—and a water tank holding about 500 gallons. In the center of the car are two compartments for carrying its load. The fish are carried in cans and square tanks, according to the size of the fish. The size of these compartments is 30 feet long, 3 feet wide, and 25 inches deep. A hatching apparatus of a capacity of 45 McDonald jars is also used on this car, and is placed on the top of the two compartments for carrying fish after moving the lids. The jars are placed in lead-lined boxes, which are of the same size as the lids and about 6 inches high. The supply of water is taken from the pressure tank. It flows from the lead-lined boxes

through a system of piping to the storage tank underneath the car. The hatching can be done while the car is in motion. In the other end of the car is a kitchen and boiler room. The boiler room contains a 5-horsepower boiler, with water pumps and air pump for circulating the water and air on the fish. Underneath the car, between the trucks, is a storage tank which will hold about 600 gallons. The water is pumped from this tank to a pressure tank near the office end of the car, after which it circulates through the square tanks or hatching apparatus in the center of the car, passing from these to the tank under the car again, so the water is used continuously. In the center of the car are four berths, together with a number of lockers and closets. The office contains one berth and a folding bed; also a writing desk and closet. The kitchen is fully equipped with range, water tanks, etc.

Transportation can:

A cylindrical can, made of iron, tinned, the top of which is contracted and provided with a cover to prevent splashing of water while in transit. Height, 24 inches; diameter, 14 inches; capacity, 12 gallons. This can is more extensively used than any other form of apparatus for the transportation of young shad, white-fish, pike perch, trout, and other fishes distributed by the U. S. Fish Commission.

Galvanized-iron transportation tank:

This tank (size, 24 by 24 by 24) is used on U. S. Fish Commission cars for transporting adult fishes and yearlings over 6 inches in length. It is so arranged as to receive a continuous supply of air, and can also be connected up with the water-supply tanks so that a continuous circulation of water is maintained.

Tin pail for rock bass:

A light tin pail, with a capacity of 2 to 4 quarts, used in shipping rock bass and bream by express.

Bucksport transportation can:

A cylindrical can, made of block tin, with top contracted, and provided with a cover, 18 inches in height and 15½ inches in diameter at base. This can is used entirely at the Craig Brook (Maine) Station for transportation of salmon fry.

Accessories.

Messenger bucket:

This bucket forms a part of a messenger's equipment, and is used for carrying extra ice, changing water, etc.

Quart dipper:

A part of the messenger outfit, used for aeration of water, sorting fish, etc.

Siphon cage:

Made of copper and tin. It is covered with cheesecloth and attached to the siphon tube for drawing off water from aquarium or cans containing fry.

Tin siphon funnel:

A cylindrical funnel, with fine perforations at bottom, a part of the messenger's outfit. Used in drawing off water from tanks containing shad and white-fish fry.

Siphon tube:

A piece of five-eighths rubber tubing, 4 feet long, used in connection with a siphon strainer for removing stale water from cans containing young fish.

Pocket thermometer:

This forms a part of a messenger's equipment, and is used for ascertaining the temperature of water while transporting fish.

Medicine chest:

This forms a part of the equipment of each of the U. S. Fish Commission cars.

Models of Station and Floating Hatchery.

Model of Leadville trout hatchery (scale of model, three-fourths inch to 1 foot):

The station is located in Lake County, Colo., 6 miles west of Leadville, on a Government reservation of 1,935 acres. It was established by act of Congress approved March 2, 1899, for the purpose of propagating black-spotted and other native varieties of trout, as well as various fishes of the salmon family from the Eastern stations. The hatchery is built of red sandstone, is equipped with 72 troughs, each 14 feet long, 14 inches wide, and 8 inches deep. It has a total capacity of 6,000,000 trout

eggs. The water supply is obtained from Rock Creek and springs on the reservation. The temperature of the water throughout the year varies from 37° to 46°, the mean being 43°.

Model of hatching barge:

The barges were generally equipped with hatching cones and Ferguson plunging buckets, and were extensively used by the U. S. Fish Commission for many years in the waters of North Carolina, Virginia, and Maryland in hatching the eggs of the shad. After the establishment of permanent shore stations the use of the barges was abandoned.

HATCHING APPARATUS.

Cod box:

This apparatus consists of a series of double rectangular wooden boxes, usually arranged in nests of 8 or 9. The eggs are placed in the inner box, the bottom of which is slightly oval instead of flat, and is covered with scrim cloth. The water is introduced from the water chamber through the bottom and through a hole several inches above the bottom, which gives the eggs a slightly rotary motion; it escapes through an intermittent siphon, which produces the tidal motion essential in hatching floating eggs.

Originally designed by Marshall McDonald in 1880 and perfected in 1888.

Model of plunging buckets:

This model illustrates the methods employed in hatching shad during the early days of the Commission. It was invented by Maj. T. B. Ferguson in 1880 and was used in the Chesapeake Bay and on the Albemarle Sound. The plunging buckets were on the outside of a barge which was fitted up with the machinery necessary for operating the same. It has also been used with slight success in the hatching of floating eggs.

McDonald's Y-shaped hatching box:

A wooden box, with glass ends and sloping sides, for eggs. Length, 12 inches; width, 24 inches; depth, 15 inches. The sides of the box slope toward the bottom center until they come within an inch of each other. Below this opening is a space 3 or 4 inches deep, for the introduction of water. This opening is nearly closed by means of an adjustable square wooden bar, one of the angles of which enters the center of the opening, the sides of the bar thus being parallel with those of the box. By this means the current is divided, so that the water is deflected along either side of the box toward the surface, carrying the eggs with it and causing them to pass in toward the center and fall again to the bottom, where they are again caught by the current and carried through the same circuit. The outlet is protected by a triangular trough running across the top center from side to side. This is placed a little below the top of the box, so that the water shall flow over its side and out through the openings. The current introduced is sufficiently strong to carry dead eggs into this trough, thus allowing them to escape, but not strong enough to carry away the good eggs, which, being heavier than the dead ones, drop before reaching the trough. Great care must be taken to see that the flow of water is properly adjusted, otherwise many of the dead eggs may be retained or the good ones may be lost.

Invented by Marshall McDonald in 1881.

Williamson hatching trough with Stone salmon basket:

A section of the hatching trough, showing three compartments complete, with three tiers of wire trays in each. In the trough a double partition separates each compartment, the first extending from the bottom of trough to within an inch of the top, while the second extends from the top to within an inch of the bottom, the two sections of the partitioning being 1 inch apart. The water passing over the first partition and under the second, into the compartment, forces its way up through the eggs on the baskets and over and under the next partitions.

Trout trough with wire trays:

This is an ordinary trout trough, 8 feet long, 12½ inches wide in the clear, and 6 inches deep, fitted with ordinary galvanized-iron wire trays, 7 meshes to the inch. Used at most of the hatcheries in the Commission for hatching brook, rainbow, and black-spotted trout eggs. The troughs in the hatcheries vary in length from 12 to 16 feet. Both the trays and troughs are painted with asphaltum varnish. Wire trays for the hatching of trout eggs were first used in 1867 by Mr. E. A. Brackett, of Winchester, Mass.

Ferguson hatching-jar:

A cylindrical jar of glass, with a contraction near the base, which serves as a support to the 7 wire-cloth egg-trays which it contains. It has two circular open-

ings on opposite sides—one at the bottom for admitting the water, which passes upward through the eggs and out through the second opening, which is situated at the top. Height, 12 inches; diameter, 8 inches. For economy of water, the outflow opening of one jar is connected with the inflow pipe of the next by means of rubber tubing. By this means the water passes through an entire series of jars before it finally escapes. The jar is used chiefly for hatching eggs of the Salmonidæ. It holds about 4,000 salmon eggs or 6,000 trout eggs.

Invented by T. B. Ferguson, 1876.

Atkins's hatching-crate:

A frame of metal and wood, with hinged cover, which incloses a nest of 9 egg-trays. Length, 12 inches; width, 12 inches; depth, 7 inches. This crate is used chiefly for hatching eggs of the Salmonidæ. The trays are provided with corner strips of wood, which separate them slightly from each other to allow free circulation of water, though the spaces are not large enough to allow the escape of eggs. These crates can be placed either in the open stream or in ordinary troughs.

Designed by Charles G. Atkins, Bucksport, Me.; presented by Mr. Atkins.

McDonald hatching-jar, old style:

Similar to improved jar now in use; but, instead of a metal cap, cork was used for the stopple. Invented in 1881; superseded in 1883 by "improved McDonald jar."

Chase hatching-jar:

A cylindrical jar of glass, with a metal rim notched at one side and provided with a wire screen for retaining the fish. The water is introduced through a glass tube at the bottom and passes upward through the eggs. Height, 16 inches; diameter, 6 inches. This jar is extensively used for hatching eggs of the white-fish. When the embryos are developing the outflow gate remains open, and through it any dead eggs are carried upward by the current and escape, thus preventing the injurious effects which arise from fungus and dead eggs.

Invented by Oren M. Chase, Detroit, Mich.

Clark hatching-jar:

A cylindrical jar of glass, with a metal rim, having a spout at one side, from which the surplus water escapes. The bottom of the jar is provided with a metal cone corresponding with the funnel-shaped end of the supply tube, which is prevented from coming in contact with it by means of slight projections on its inner surface. Height, 18 inches; diameter, 6 inches. This jar is coming into favor for hatching eggs of the white-fish, and is used extensively at the Northville hatchery.

Designed by Frank N. Clark, Northville, Mich.

McDonald white-fish jar:

This is the same as the jar used for hatching shad, known as the McDonald universal hatching-jar, with the exception that the closed top is removed and an open top with a tin funnel 3½ inches long substituted in its place, through which the water escapes. The tube supplying the water is suspended from above to within one-eighth of an inch of the bottom of the jar, and is made of either glass, tin, or iron.

McDonald's universal hatching-jar:

A glass jar with metal cap, containing two circular openings. Through one of these, which is situated in the center, a glass tube for the introduction of water passes to within a short distance of the bottom of the jar. The other, situated near one side, contains a shorter glass tube, which serves as an outflow pipe. Height, 15 inches; diameter, 6 inches; capacity, 5 quarts. The McDonald jar is successfully employed in the hatching of various species of heavy eggs. The water in entering is thrown against the bottom with considerable force, and is deflected upward around the sides of the jar. The eggs, which tend to settle to the bottom, are carried upward along the sides, thence inward toward the center, from which point they again sink to the bottom. The current is regulated to give the desired motion to the eggs. With heavy eggs like those of the salmon there is no motion, but the water coming from beneath tends to buoy the eggs upward, thus preventing any injurious pressure on the lower ones by the mass above. The outflow pipe is movable, and can be lowered to a point where the dead eggs, which are lighter than the good ones, come in contact with it and are carried off. By this means the eggs are kept comparatively free from the injurious effects of fungus growth or decaying eggs. The jar can be filled two-thirds full of eggs with very satisfactory results, 75,000 shad eggs being considered a fair quantity.

Patented by Marshall McDonald, Washington, D. C., in 1882.

ACCESSORIES TO HATCHING APPARATUS.

Aquaria:

Receptacle, rectangular in shape, made of glass, slate, and iron; 48 inches long, 18 inches wide, 18 inches deep; into which the fry pass from the jars as soon as they are hatched. The aquaria is placed in the center of the hatching-table and receives the fry from about 14 or 15 jars; as soon as they become crowded they are transferred to the fry troughs usually arranged around the hatchery.

Hand dip-net (aluminum):

A small net used at Central Station, Washington, D. C., for transferring single specimens from aquaria. Frame of brass wire, No. 11, American gage, 3½ inches in diameter; handle of wood, 18 inches long; mesh of net, one-fourth and one-eighth inch by 6 inches deep.

Trough net:

Square frame of aluminum covered with fine-meshed netting and provided with handle for removing young salmon and other small fishes from hatching-troughs.

White-fish dip-net:

This net is used at Alpena Station in transferring the white-fish fry from receiving tanks to the transportation cans.

Jar scaff net:

Used for removing foreign matter from full jars of semi-buoyant eggs. Brass-wire frame and handle; bowl square or circular, 2½ inches to 3 inches in diameter; handle 19 inches long; netting of gilling twine, one-fourth inch mesh.

Scaff net:

Small square nets, with short handles of metal, for taking dirt from trout troughs.

Siphon cage:

Made of copper and tin. It is covered with cheese-cloth and attached to the siphon tube for drawing off water from aquarium or cans containing fry.

Siphon cup:

A tin cup placed under the end of a siphon to keep it from breaking when the water gets too low in the aquarium.

Egg funnel:

A shallow funnel especially designed for introducing fish eggs into the different kinds of hatching-jars. Netting made of gilling twine, one-fourth inch mesh, is advantageously used over mouth of funnel to keep scales, etc., from going into the jar.

Tally board: Used for keeping count of trout fry and yearlings at Leadville, Colo.

Liver strainer:

An ordinary tin pan, with perforated bottom. The liver is passed through this strainer before feeding to the young fry, to insure its being thoroughly cut up.

Perforated ladle:

An ordinary iron cooking ladle, with perforated bowl, used in handling trout eggs during the period of incubation in the hatching troughs.

Perforated dipper: Used in handling trout eggs during incubation.

Seagle hatching-trough: Model with sliding screen instead of fixed screen in head of trough. Advantage claimed in cleaning trough with young fish in it.

Egg nippers:

Made of wood, tin, and brass, of various styles, for removing dead and unimpregnated trout and salmon eggs.

Page's egg scale:

A small wooden square laid off in grades and numbers. The scale is designed to determine the number of eggs of any species in a McDonald hatching-jar. The grades correspond to one-half pint contents of the jar, and the number of eggs per half pint has been determined by counting 1 quart of eggs of each species.

Measure for counting white-fish eggs:

Devised by Mr. J. J. Stranahan, of Put-in Bay, Ohio, for counting rapidly a quart of white-fish eggs—applicable to any other species.

Feathers: Used in cleaning and manipulating trout and salmon eggs.

Collecting Outfit.

The spawn-taker:

This lay figure represents a man in the act of taking the eggs from a ripe salmon. The fish casts in front of him show the condition of the ovaries and spermaries of ripe male and female salmon.

Spawn-taker's bucket:

Part of a spawn-taker's outfit, and is principally used in the collection of shad eggs. After the eggs have been fertilized and all of the pans refilled they are emptied into the bucket, where they are held until they reach the hatchery, the water being changed from time to time.

Spawning pans:

May be of either tin, wood, or marbleized iron, and form a part of a spawn-taker's outfit in collecting eggs of white-fish, trout, shad, etc.

Collins's egg pan:

An oblong pan with a tumble-in top, provided with an iron bail and cover, the latter preventing loss of eggs from slopping out, and the former facilitating the handling of apparatus in the boat. Pan is 18½ inches long, 10¼ inches wide, 8½ inches high, without cover; tinned and shellacked inside to prevent the iron corroding from contact with sea water. Designed by Capt. J. W. Collins.

Salmon spawning box or jacket:

A wooden box 42 inches long and tapering from 8½ inches to 3½ inches in height, and from 5 inches to 1½ inches in width. This box is used on the Columbia and Rogue rivers in stripping ripe salmon. The fish is placed on its back in the box, its head being secured with wooden slide and tail by a strap attached near the small end of the box, and is readily stripped by one man, whereas two or perhaps three men would be required without the box.

Invented by R. D. Hume, of Golden Beach, Oreg., in 1879.

Results of Fish-culture.

Chart illustrating the effects of fish-culture on the shad fishery.

Improved Cail Fishway.

[Scale of model 1 inch to the foot. Inclination 1 to 4.]

A series of comparatively still-water compartments arranged in steps and separated by cross bulkheads with suitable openings allowing the fish to ascend the fishway by either leaping the small waterfalls over the bulkheads or passing through the openings. This fishway can be constructed of either timber, masonry, or concrete, and on a straight line or angles and curves, as the conditions may require. It is applicable to the various forms of existing dams and natural falls, and owing to the abundance of light through the open spaces on top can be readily inspected and the débris easily removed. Protection against drift ice and logs during freshets is provided, and there are no regulating gates or other devices requiring an attendant. The floor compartments are slightly inclined, and the bulkheads run obliquely in order that the current passing through can readily clear gravel, sand, mud, and other rubbish, which is an improvement over many other types of fishways. The original fishway was designed by Mr. Richard Cail and is used successfully in Scotland.

Improvements were made by H. von Bayer, architect and engineer of the U. S. Fish Commission, as follows: (1) Beginning at the top the openings in bulkheads are decreased successively so as to insure an overflow over each bulkhead down to the lowermost in case of any leakage in the fishway. (2) The bulkheads are placed obliquely across the fishway, so as to make each compartment self-cleaning.

Photographs illustrating Fish-cultural Operations at the Stations and on Vessels of the U. S. Fish Commission.

Rearing ponds and buildings in background, Craig Brook, Me.
Tents, hatchery, and barracks, Craig Brook.
Upper tier of rearing troughs, Craig Brook.
Lower tier of same.
Rearing troughs and hatchery, Craig Brook.
Winter storage tanks, Craig Brook.
Fly house, Craig Brook.
Interior of fly house, Craig Brook.
Rearing ponds, Craig Brook.
Pond covered with netting, Craig Brook.
Hatchery and lake, Grand Lake Stream, Maine.
Fish inclosure and watchman's lodge, Grand Lake Stream.

PHOTOGRAPHS ILLUSTRATING FISH-CULTURAL OPERATIONS—Continued.

Taking ripe salmon from inclosure, Grand Lake Stream.
Stripping and impregnating eggs, Grand Lake Stream.
Packing eggs for shipment, Grand Lake Stream, 2 views.
Interior of second story of hatchery, Grand Lake Stream.
Picking dead eggs from hatchery trays, Grand Lake Stream.
Weighing, measuring, and tagging salmon, Bucksport.
Tagging salmon, Bucksport.
Lower barrier of inclosure for retaining unripe salmon, Bucksport.
Spawning and tagging shad, Bucksport.
Men transporting salmon in dory cans, Bucksport.
Salmon dory car, Bucksport.
Superintendent's residence, Green Lake station.
Reservoir, hatchery, stable, Lower Green Lake in distance.
Hatchery, Green Lake station.
Interior of hatchery, Green Lake station.
Rearing troughs, Green Lake station.
Troughs of Atlantic salmon eggs, Green Lake station.
Temporary rearing-equipment bed of Waste Brook, Green Lake.
Spawning house and inclosure for salmon at Great Brook, Green Lake.
Residence and rearing ponds, St. Johnsbury, Vermont.
Bird's-eye view, St. Johnsbury.
Interior of hatchery, St. Johnsbury.
Hatchery, St. Johnsbury.
Ponds drawn off, St. Johnsbury.
Rearing ponds, St. Johnsbury.
Hatchery, Nashua station, New Hampshire.
Interior of hatchery, Nashua.
Reservoir, looking east, showing buildings, Nashua.
Rearing ponds, Nashua.
Residence, Nashua.
View of station, Nashua.
Hatching house, looking northeast, Gloucester, Mass.
Interior of hatchery, Gloucester, Mass.
Interior of hatchery, showing apparatus, Gloucester, Mass.
Spawn-takers boarding sloop *Venus*, Gloucester, Mass.
Stripping cod on sloop *Venus*.
Building containing hatchery, laboratory, aquarium, and museum, Woods Hole, Mass.
Bird's-eye view of Woods Hole station.
Superintendent's residence, Woods Hole.
Interior of hatchery, showing McDonald cod-boxes, Woods Hole, 2 views.
Interior of hatchery, showing Chester cod-boxes, Woods Hole.
Interior of hatchery, showing McDonald lobster jars, Woods Hole.
Marine aquaria, Woods Hole.
Bird's-eye view of Battery Island, Havre de Grace station, Maryland.
Superintendent's cottage, looking northeast, Battery Island.
Hatching house, engine room, and tank tower, Battery Island.
Interior of hatchery, Battery Island.
Fishermen's boats in harbor, Battery Island.
Landing a shad seine, Battery Island.
Packing shad eggs for shipment, Battery Island.
Spawn-taker stripping a ripe shad, Battery Island.
Launch *Canvasback* towing out spawn-takers, Battery Island.
Launch with shipment of shad fry to Havre de Grace.
Bird's-eye view of Bryan Point station, Maryland.
Seine beach and captain's quarters, Bryan Point.
Seiner's quarters, Bryan Point.
Mess house and quarters for men, Bryan Point.
Launches at the wharf, Bryan Point.
Wharf and water tank, Bryan Point.
Office building and Central station, Washington, D. C.
Interior of Central station.
Bird's-eye view of Fish Lakes, Washington, D. C.
Fish Lakes, showing spawning inclosures and rearing ponds for bass, Washington, D. C.
Fish Lakes, showing bass ponds and ponds for rearing fish food, Washington, D. C.
Fish Lakes, sorting and counting fish, Washington, D. C.
Hatchery, Wytheville, Virginia.
Bird's-eye view, Wytheville.
Superintendent's residence, Wytheville.
Interior of hatchery, Wytheville.
Rearing ponds, looking west, Wytheville.
Rearing ponds, looking northwest, Wytheville.
Spawning ponds, showing raceway, Wytheville.
Spawning ponds, Wytheville.
Bass ponds, Wytheville.
Spring which furnishes water supply, Wytheville.
Hatchery, Erwin, Tennessee.
Interior of hatchery, Erwin.
Foreman's dwelling, Erwin.
Pond system, Erwin.
Bird's-eye view, Erwin.
Stock ponds, Erwin.
View on rounding Albania Point, Edenton station, North Carolina.
Bird's-eye view, Edenton.
Interior of hatchery, Edenton.
Hatchery, Edenton.
Landing pier, Edenton.

PHOTOGRAPHS ILLUSTRATING FISH-CULTURAL OPERATIONS—Continued.

Looking toward Edenton from office.
Bird's-eye view of Bullochville, Ga.
Rearing ponds at Bullochville.
Residence at Bullochville.
View from residence, Bullochville.
Bass ponds at Bullochville.
Spring at Bullochville.
Hatchery, Cape Vincent station, N. Y.
Interior of hatchery, Cape Vincent.
Hatchery, Put-in Bay station, Ohio.
Packing white-fish eggs, Put-in Bay.
Interior of hatchery, Put-in Bay, 2 views.
Superintendent's residence, Northville station, Michigan.
Hatchery, Northville, Mich.
Interior of hatchery, Northville, Mich.
Catching, selecting, and stripping trout, Northville, Mich.
Hatchery, Alpena station, Michigan.
Interior of hatchery, Alpena, Mich.
Removing green eggs from shipping trays, Northville, Mich.
Packing eyed eggs, Northville, Mich.
Hatchery, Duluth station, Minnesota.
Hatchery, nursery troughs, and storehouse, Duluth.
Lester River and flume supplying water to hatchery, Duluth.
Lester River, hatchery in background.
Superintendent's residence, Manchester station, Iowa.
Hatchery, Manchester, Iowa.
Foreman's dwelling, Manchester, Iowa.
Bird's-eye view, showing spawning ponds, Manchester, Iowa.
Rearing ponds, Manchester, Iowa.
Stock ponds, Manchester, Iowa.
Superintendent's residence, Neosho station, Missouri.
Hatchery, Neosho.
Rearing ponds, looking east, Neosho.
Rearing ponds 1, 2, and 5, Neosho.
Pond 4 being drawn off, Neosho.
Spring which supplies the ponds, Neosho.
Pumping plant, Quincy station.
Crew leaving station.
Laying out the seine.
Boating the seine.
Ready to land seine.
Seine landed, assorting fish.
Superintendent's residence, San Marcos station, Texas.
Office and upper ponds, San Marcos.
Circular bass ponds, San Marcos.
Bird's-eye view, San Marcos.
Rearing ponds, San Marcos.
Crappie ponds, San Marcos.
Hatchery at Spearfish, South Dakota.
Bird's-eye view, Spearfish.
Trout ponds, with hatchery in background, Spearfish.
Rearing ponds looking north, Spearfish.
Upper spring, furnishing part of water supply, Spearfish.
Lower spring, furnishing part of water supply, Spearfish.
Hatching house and residence looking north, Leadville station, Colo.
Hatching house and residence after heavy fall of snow, Leadville.
Bird's-eye view, Leadville.
Superintendent's residence, Leadville.
Hatchery, Leadville.
Interior of hatchery, Leadville.
Preparing fish food, Leadville.
Feeding trout in ponds, Leadville.
Catching spawning trout, Leadville.
Sorting and stripping ripe trout, Leadville.
Bird's-eye view of Bozeman station, Montana.
Superintendent's residence, Bozeman.
Hatchery, Bozeman.
Interior of hatchery, Bozeman.
Hatchery at Battle Creek station, California.
Rack across stream for stopping the ascent of salmon, Battle Creek.
Seining boat and whim, Battle Creek.
Ponds for retaining salmon and spawning platform, Battle Creek.
Interior of hatchery, Battle Creek.
Salmon hatching baskets, Battle Creek.
West end main rack, Battle Creek.
Rear view main rack, Battle Creek.
Entrance to trap, Battle Creek.
Spawning a salmon, Battle Creek.
The spawning platform, Battle Creek.
Disposing of dead fish, Battle Creek.
Hatching house, Baird station, California.
Seine boats, Baird.
Hatchery, Baird.
Interior of hatchery, Baird.
Salmon rack, water wheel for furnishing water supply, Baird.
Water wheel, Baird.
Superintendent's residence, Baird.
Mess house, Baird.
Station looking east, Clackamas station, Oregon.
Dam across river, Clackamas.
Interior of hatchery, Clackamas.
Rearing salmon, Clackamas.
Hauling seine, Clackamas.
Packing salmon eggs, Clackamas.
Stripping salmon, Clackamas.
Steamer *Fish Hawk*.
Main deck of the *Fish Hawk*, showing McDonald jars, 2 views.
Main deck of the *Fish Hawk*, showing Chester jars.
Operating beam trawl, *Fish Hawk*.
Hoisting and reeling engine, *Fish Hawk*.
Schooner *Grampus*.
Car No. 3, 2 views.
Interior of car No. 3.
Interior of car, showing hatching apparatus in operation.

DIVISION OF STATISTICS AND METHODS OF THE FISHERIES.

Mammals:

1. Sirenians: Manatee (cast).
2. Cetaceans: Common dolphin (cast). Black-fish (cast). Grampus (cast). Harbor porpoise (cast).
3. Carnivores:
   (*a*) Earless seals: Harbor seals (live specimens in pool).
   (*b*) Eared seals: Northern fur seals, Alaska.

   This group represents a section of a seal rookery on the Pribilof islands. Fur seals are polygamous, and the rookeries or breeding grounds are composed of thousands of harems, containing 5 to 50 females each. The male is much larger than the female. The young males are driven away from the rookery by the adult males and compelled to herd by themselves. Seals are selected for killing by the United States Government from the young males, females never being disturbed, but the American fur-seal herd is constantly decreased by poachers, who kill female seals at sea.

Reptiles:

1. One 7-foot Florida alligator (mounted).
2. Turtles and tortoises; loggerhead turtle (cast); hawksbill turtle (polished mounted shell); hawksbill turtle from the Philippine Islands (unmounted shell); green turtle (cast). Soft-shell turtle (live specimens in aquaria). Snapping turtle (live specimen).

Fish:

Casts and stuffed skins of 75 species of marine and fresh-water food-fishes.
Colored drawings of fish.
Living marine and fresh-water fish in aquaria, representing 147 species.

Invertebrates:

Living sea-anemone, starfish, crabs, lobsters, mollusks, etc., in aquarium.

Model illustrating fishing scenes on the New England coast:

This model represents the five important methods employed in the capture of fish and lobsters for commercial purposes by fishing vessels along the New England coast.

The gill net, set at the surface of the water, is used for catching mackerel, herring, and other fish that school on the surface. The mesh of the net varies in size from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches, and the vessel carries, on an average, ten nets to each member of the crew.

At the rear of the gill net set at the surface is a trawl; this varies in length and has short lines with hooks fastened to it at regular intervals, the intervals varying from 3 to 15 feet, according to the fishery in which the line is used. In the haddock fishery the hooks are 3 feet apart; in the halibut, 12 to 15 feet. The trawl is set by allowing it to sink to the bottom, the ends being secured by anchors, from which long lines lead to the surface, where they are attached to buoys or kegs, so that the fishermen can locate the trawl. Each line of trawls is about 50 fathoms long, and each member of the crew has from 21 to 50 lines to fish, or from 1,500 to 3,000 hooks. Cod, haddock, halibut, and pollock are the principal fishes caught by this method.

The purse seine is principally used for capturing mackerel, herring, and menhaden. The average mackerel purse seine is about 225 fathoms and 1,000 meshes deep (2-inch mesh), and cost from $500 to $800 each. It is set around a school of fish so as to form a bag or purse, as shown by model.

The net set on the bottom illustrates the use of gill nets in catching cod, which always school near the bottom of the ocean. The fish are caught by passing their heads through the meshes of the nets.

The lobster traps are set on the bottom and show the method of catching lobsters. The light-house in the background is Thatcher's light-house, north of Cape Ann.

U. S. Fish Commission schooner Grampus (rigged model; scale, $\frac{1}{2}$ inch to 1 foot):

The *Grampus* was designed by and built under the supervision of Capt. J. W. Collins, U. S. Fish Commission. She was launched in the spring of 1886, and went into commission on June 5 of that year. She is provided with a well, located in the middle of the vessel, in which the fish and other marine animals can be kept alive and taken from distant fishing-grounds to the coast stations of the Commission for fish-cultural purposes or to serve as objects of study and research for biologists. In other important respects she is arranged and fitted to adapt her to carrying on the marine researches and investigations which are being continuously prosecuted by the Commission. Among other things, she has been fitted to operate a beam-trawl, to test its utility, in a commercial way, in American waters.

The *Grampus* is a two-masted, schooner-rigged vessel, 90 feet long over all; 81 feet 6 inches L. W. L.; 22 feet 3 inches beam, and 10 feet depth of hold. She registers 83.30 tons. An important object sought in her design was the production of a new type of fishing vessel—one that will be much safer and in various ways better adapted to successfully encounter the exigencies which must be met by schooners employed in the ocean fisheries. In model and rig she is a radical departure from the vessels commonly engaged in the New England fisheries prior to her advent, and her superiority in safety, speed, and other desirable qualities has been fully established. After twelve years' service the *Grampus* is unexcelled in speed by fishing vessels or pilot boats. She differs from the typical fishing schooner, at the time she was built, in being 18 to 24 inches deeper, in having 6 to 10 inches less beam, and an easier after section. She has less proportional width aft, greater rake to stern, and pilot-boat bow, with straight stem above water. Her extreme draft is 11½ feet.

The principal features of the *Grampus* have been copied by New England builders. Nearly all of the fishing vessels recently built are deeper than formerly, and embody other features that characterize the *Grampus*. The spirit of improvement has received such an impetus that the best skill of the most eminent naval architects has of late been devoted to designing fishing vessels.

New England mackerel seining schooner (rigged model: scale, ½ inch to 1 foot):

The schooner *Senator Gardner*, of Gloucester, Mass., was built in Essex, Mass., in 1900, for employment in the summer mackerel fishery and in the winter frozen-herring trade. It represents a vessel of modern type, suitable for all branches of the fisheries. The model shows a mackerel seiner all ready to start on a cruise; seine boat on deck and seine stowed on deck, ready to take in boat on its arrival on the fishing-grounds.

Length over all, 114 feet; water-line length, 92 feet; beam, 25 feet; depth, 11 feet 6 inches; gross tonnage, 135; bowsprit, outboard, 30 feet; foremast from deck, 65 feet; foretopmast, 42 feet; mainmast, 70 feet from deck; maintopmast, 44 feet; main-boom, 67 feet; maingaff, 37 feet; foreboom, 31 feet; foregaff, 32 feet; jumbo-boom, 27 feet; seine boat, 40 feet long over all by 8 feet 6 inches beam.

New England market fishing schooner (rigged model: scale, ½ inch to 1 foot):

The schooner *Rob Roy*, of Gloucester, Mass., was built at Essex, Mass., in 1900, for employment in the market fishery, and is an entirely new model in fishing vessels, called the "knock-about" type. She is an ideal market fishing craft, as she is easily handled around the dories when out setting or hauling trawls, and is a smart sailer and an excellent sea boat. The model represents a market fisherman as she appears ready to go to sea; dories on deck, nested right side up.

Length over all, 110 feet; water-line length, 88 feet; beam, 23 feet 6 inches; depth, 11 feet; bowsprit, outboard, 26 feet; foremast, 58 feet from deck; foretopmast, 37 feet; foreboom, 28 feet; foregaff, 27 feet; mainmast, 71 feet from deck; maintopmast, 41 feet; mainboom, 66 feet; maingaff, 36 feet.

Designed by B. B. Crowinshield, Boston, Mass.

New England Grand Bank Schooner (rigged model: scale, ½ inch to 1 foot):

The schooner *John J. Flaherty*, of Gloucester, Mass., was built at Essex, Mass., in 1899, for Grand Bank cod fishing in summer and in the winter frozen-herring trade. The model represents a fast and seaworthy vessel, ready to go to the Banks on a cruise. She is under full sail, with dories turned up and secured on deck, and checkerboard and oil butts in place. She illustrates the extreme type of Grand Banker, and is a very easy vessel to anchor in a heavy sea. Carries 2,200 barrels of herring, and had 600,000 pounds of cod on her first Grand Bank trip.

Length, over all, 122 feet; water-line length, 102 feet; beam, 25 feet 6 inches; depth, 12½ feet; gross tonnage, 166.35; bowsprit, outboard, 36 feet; foremast, 64 feet from deck; foretopmast, 39 feet; foreboom, 33 feet; foregaff, 34 feet; mainmast, 76 feet; maintopmast 44 feet; main boom, 70 feet; main gaff, 40 feet; jumbo boom, 28 feet.

Designed by Lawrence Jensen, Gloucester, Mass.

Chesapeake Bay oyster pungy (rigged model: scale, ½ inch to 1 foot):

The schooner *W. F. McKewen*, of which this is a miniature, is a typical oyster pungy of the Chesapeake Bay region, where hundreds of such vessels are employed. She was built in 1865, and was engaged in dredging oysters for many years. This type of fishing vessel has undergone little change in half a century.

A carvel-built, wooden, keel vessel, with moderately sharp, flaring bow, curved, strongly raking stem, long head, sharp floor, long, lean run, shallow, square stern, raking sternpost, flush deck, log rail except aft of main rigging where there is an open quarter rail, rollers on rail amidships for dredge rope to pass over, typical schooner rig. Model equipped with oyster dredges, winches, etc.

Length, over all, 68 feet; beam, 20 feet 9 inches; depth, 7 feet.

The builders at Baltimore and other ports on the Chesapeake began the construction of sharp vessels much earlier than elsewhere on the Atlantic coast, and oyster pungies substantially like those used in the closing years of the nineteenth century were built as early as 1845 or 1850. Almost without exception these are keel vessels, with tall, raking masts, long bowsprit, and high, narrow sails. They are swift, and quick in stays.

New Orleans fishing lugger (rigged model: scale, 1 inch to 1 foot):

Model of the typical lug-rigged boat, so extensively used in the fisheries from New Orleans and vicinity by fishermen who are chiefly Italians or other natives of southern Europe. This represents a carvel-built, center-board boat, half deck forward, with wide washboards and high combing around the elliptical-shaped cockpit, the latter being fitted with hatches at cover, about two-thirds of its length from the forward part. There is a cuddy forward, which is entered through an opening in front of the mast. The boat has a graceful sheer, increased forward to a bow shape; a sharp bow, with concave water line and straight stem; very shallow keel; moderately rising floor, with quick turn to bilge; medium length of run; V-shaped, square stern, with no overhang to counter; rudder hung outside and moved by tiller. The rig consists of a single mast, 12 feet abaft the stem, and on this is set a single large lug-sail, which tacks to a traveler near the bow, where the sheave trims to an iron traveler across the taffrail or at the stern. The sail is not dipped in making short tacks to windward. Boats of this class are not used anywhere in the United States except on the Gulf coast, and are restricted there chiefly to Louisiana. They are celebrated for speed, and are reputed to be especially well adapted to the shallow, narrow waters in which they have to work.

Length, over all, 40 feet 6 inches; length of water line, 39 feet 9 inches; beam, 12 feet 3 inches; depth, amidships, keel to top of gunwale, 4 feet 9 inches; draft, aft, 2 feet 9 inches; forward, 1 foot 9 inches; length of mast, extreme, 45 feet; length of yard, 38 feet 6 inches.

Key West smackee (rigged model: scale, 1 inch to 1 foot):

The welled fishing boat *Jeff Brown*, of Key West, Fla., of which this is a miniature, was built for the market fishery at that port in 1883. Boats of this kind are called "smackees," a variation of the term "smack" as applied to welled vessels. They are employed in considerable numbers at Key West, and are noticeable for having the "Mudian rig"—a leg-of-mutton mainsail and jib—and also a well in which the fish are kept alive.

A wooden, carvel-built, sloop-rigged keel boat, with good sheer; sharp bow, rising floor, long run and skag; V-shaped, raking stern; cockpit aft; well amidships, cuddy hatch forward; mast stepped well forward; short bowsprit. Length, over all, 24 feet; beam, 8 feet 3 inches; molded depth, 3 feet; mast, above deck, 32 feet; bowsprit, outside, 6 feet; main boom, 23 feet.

The majority of the Key West smackees are slightly smaller than the *Jeff Brown*, and differ from the latter in having square vertical sterns, with their rudders hung outside. They sail well and are reputed to be seaworthy and able in strong winds.

Connecticut oyster steamer (rigged model: scale, ½ inch to 1 foot):

Model of the oyster steamer *Jeremiah Smith*, of New Haven, Conn. This vessel was built in 1885, at West Haven, Conn., and is one of the largest and finest vessels of this class, constructed for the special purpose of carrying on the oyster fishery in Long Island Sound. The model is fitted with boats, dredges, etc. This vessel is wide and rather flat, with moderately sharp bow and low, rounding bilge; rather short run; large deck houses; provided with rollers for operating the dredge; side chafing chocks, etc. The wheelhouse is above the main-deck house. The vessel is fitted with a screw propeller, and will steam about 7 or 8 knots.

Gross tonnage, 113.38; net tonnage, 66.68; length, over all, 72 feet; extreme beam, 24 feet; draft, 6 feet.

Market steamer Golden Gate (rigged model: scale ½ inch to 1 foot):

The *Golden Gate* was built in 1891 for employment in the market fishery from San Francisco, Cal. It is a representative of the type of small steamers, of which several have been built to fish from San Francisco with the parenzella. The building of such vessels for the market fisheries of the Pacific coast was suggested by the U. S. Fish Commission in an article published in 1888, entitled "Suggestions for the employment of improved types of vessels in the market fisheries, etc." Sharp bow; straight stem above water line, curved below; moderate rise to floor; long, lean run; round stern; strong sheer; engine and pilot houses on deck; sloop-rigged, with loose-footed gaff mainsail.

Length, over all, 80 feet; beam, 18 feet; depth, 7 feet; mast, deck to truck, 60 feet; gaff, 20 feet; mainsail: on foot, 62 feet; luff, 36 feet; head, 18 feet 6 inches; leach, 59 feet; jib: luff, 47 feet; leach, 45 feet; foot, 15 feet.

Steam schooner Royal (rigged model: scale ½ inch to 1 foot):

The schooner *Royal* was built at Benicia, Cal., in 1891, and is owned at San Francisco. She is a representative of the type of small auxiliary steam schooners employed in the Alaskan salmon fishery, and is noticeable for having pole masts and a leg-of-mutton mainsail, which are characteristics of schooners fishing in Alaskan waters. Long, sharp bow; raking, curved stem; rising floor; medium length of run; overhanging, elliptical stern; good sheer; fitted with deck houses; screw propeller, and rigged as a two-masted schooner.

Length, over all, 81 feet; tonnage length, 75 feet; beam, 20.6 feet; depth, 8.2 feet; net tonnage, 29.54; nominal horsepower, 20; mainmast, deck to truck, 56 feet; foremast, deck to truck, 56 feet; bowsprit, outboard, 13 feet; main boom, 44 feet; foregaff, 16 feet.

New England dory:

Fully equipped model, with trawl lines, tubs, anchors, oars, etc., for the Bank cod fishery. Similar boats are employed in the halibut, shore cod, market, and other fisheries. Each vessel carries 3 to 9 dories and 1 or 2 men go in each dory.

Croatan Sound fishing boat (rigged model: scale, 1 inch to 1 foot):

Sloop boats of this type are used in large numbers in the gill-net shad fishery of Croatan Sound and adjacent waters in North Carolina. Many of them are built on Croatan Island. They are well adapted to the shad fishery, being fine sailers and easy to row. This is a wooden, carvel-built, open, centerboard boat; long, sharp bow; rising floor; long, fine run; raking, V-shaped stern; good shear; a single mast; loose-footed, sprit mainsail and jib, the latter tacking down to the stem head.

Length, over all, 23 feet 6 inches; beam, 7 feet; depth, top of gunwale to keel, amidships, 2 feet 6 inches; mast above thwart.

Pound-net boat:

Used on Great Lakes in lifting pound and trap nets.

NETS.

515. *Irish drop net:*

This net is used by the Irish fishermen in Boston and other New England towns in capturing perch for the fresh-fish market.

516. *Snap net:* Used for catching cunners on the New England coast.

517. *Crab net:* Used for catching crabs.

517½. *Terrapin net:* Used on the Pacific coast.

518. *Cast net:* 4½ feet, five-eighth mesh, mounted.

Used on Atlantic coast, chiefly for catching shrimp, though also for fishes.

519. *Cast net:* 4½ feet, 1¼ mesh, mounted.

520. *Bag seine* (*model*):

Very generally used throughout the country for fishing in shallow water, for taking shrimp, herring, mackerel, shad, and for general river fishing.

521. *River seine* (*model*):

Used in great variety of sizes for inland river and fresh-water fishing.

522. *Purse seine* (*model*):

This represents the style of purse seine in general use on the Atlantic coast and Gulf of Mexico for taking mackerel and menhaden. They are made in lengths from 180 to 250 fathoms and from 8 to 20 fathoms deep. For mackerel the mesh is commonly 1⅞ or 2 inches and for menhaden a larger variety is used, running from 1¾ to 2¾ inches. They are made of a light cotton twine, graded from a very small size on the ends to a heavier and a stronger size in bunt.

523. *Minnow seine:*

For taking bait, small fish, etc. Mesh one-half inch. Loaned by the American Net and Twine Company, Boston.

524. *Capelin seine* (*model*):

Used in Nova Scotia, New Brunswick, Labrador, and Newfoundland fisheries; 20 to 75 fathoms long and 2 to 8 fathoms deep. The mesh is graduated from three-fourths inch in bunt to 2 inches on end of arms. When launce are to be taken a three-eighths-inch mesh bunt is put into the center of the seine.

525. *Cod seine (model):*

Used in Nova Scotia, New Brunswick, Labrador, and Newfoundland fisheries; 100 to 130 fathoms long and 10 to 15 fathoms deep. The mesh is 3 inches in bunt, and on each side is graduated—3½ inches, 4 inches, 4½ inches to 5 inches on extreme ends. Made of cotton cod-seine twine.

526. *Herring seine (model):*

Used in British North American and Newfoundland fisheries; 50 to 150 fathoms long and 4 to 10 fathoms deep. The bunts are generally made of 1½ or 1¾ inch mesh, and the arms of 2-inch mesh. Made of cotton herring-seine twine.

527. *Cod trap (model):*

Used principally on the Newfoundland and Labrador coast; 8 to 16 fathoms square and 8 to 12 fathoms deep. The pot is made of 4-inch mesh and the leader of 5 to 6 inch mesh. Made of cotton trap twine.

528. *Lake Erie pound (model):*

Used on the Great Lakes for taking white-fish, trout, saugers, etc. Pots are from 30 to 45 feet square and from 30 to 60 feet deep; hearts 108 feet long; pots are of 2¼-inch mesh, hearts are 3½-inch mesh, and leaders are of 5 to 6 inch mesh. Made of cotton trap twine.

529. *Bass or stub trap (model):*

Used for taking bass, scup, flounders, and other fish on North Atlantic coast. Crib or pot is from 20 to 30 feet square and 20 to 30 feet deep. Crib, 2½-inch mesh. Small hearts, 2½-inch mesh; large hearts, 3-inch mesh. Leader, 5-inch mesh.

530. *Rose floating trap (model):*

Used on Rhode Island coast for scup and bass; 30 to 50 fathoms long by 10 to 25 fathoms wide and 8 to 14 fathoms deep. The mesh in head end of trap is 3 inches to 3½ inches and in front end 4½ to 5½ inches. Leaders about 5½-inch mesh.

531. *Heart trap or weir (model):*

Used on the Atlantic coast for taking herring, mackerel, blue-fish, cod, etc. Bowl 96 feet across and from 25 to 50 feet deep. Rim, 1¾-inch mesh. Hearts, 240 feet long, 4-inch mesh. Leaders, 6 to 12 inch mesh, and made of cotton trap twine.

532. *Small fyke:*

For taking cat-fish and other fresh-water fish in rivers and ponds.

533. *Eel fyke:* Used for taking eels in creeks and rivers emptying into the sea.

534. *Small flounder fyke:* Used in taking flounders along the Atlantic coast.

535. *Blue-fish gill net (model):*

Made in great variety of sizes, from 50 yards to 200 yards long and from 4 to 12 yards deep. The mesh varies for different localities from 4 to 6 inches. Blue-fish *gill seines* are made in similar way, but are 400 yards long in two pieces, and 75 to 80 meshes deep. They are leaded heavily enough to sink and fish on the bottom.

536. *Shad drift gill net (model):*

Made in a very great variety of lengths to suit the place where they are to be used, from 40 to 50 meshes deep. Twine used is No. 30 to No. 40—2 and 3 cord linen. When these nets are set stationary on stakes no floats are used and very few sinkers.

537. *Salmon gill net (model):*

Used on the Columbia River and made in different lengths, a common length being 150 fathoms. They are 33 meshes deep and 9¾-inch mesh, of No. 40—12 or 13 ply linen, and 60 meshes deep of 7¼-inch mesh, No. 40—8 and 9 ply linen. On Frazer River they are used 40 meshes deep of 5⅞-inch mesh of 4 and 5 ply linen.

538. *Herring gill nets (model):*

A variety of sizes for different localities, from 20 to 75 fathoms long and 110 to 250 meshes deep, of 2¼ to 3¼ inch mesh, of cotton gill-net twine.

539. *Cod gill net (model):*

Used on the New England coast and are made 75 yards long, 18 meshes deep, 8½ to 9½ inch mesh, of medium-laid cotton twine. Glass balls are used for floats and bricks for sinkers.

540. *Baird seine:*

Barked and fitted, 125 feet long, 13 feet deep in center and 10 feet at ends, with bag 10 feet in diameter and 10 feet long, hung to double six-thread tarred manila, with 20 6-space 3-inch corks and 128 leads.

541. *Baird seine:*

Barked and fitted, 45 feet long and 6 feet deep, with bag 5 feet in diameter and 8 feet long, hung to double six-thread tarred manila, 72 3-inch corks and 50 leads.

542. *Shad gill net:* Completely rigged, 5-inch mesh, 100 feet long.

543. *White-fish gill net:* Completely rigged, ordinary sized mesh, 100 feet long.

544. *Sturgeon net:* Ordinary sized mesh, completely rigged, 100 feet long.

545. *Cod gill net:* Completely rigged, usual sized mesh, 100 feet long.

546. *Salmon gill net:* Completely rigged, usual sized mesh, 100 feet long.

547. *Herring gill net:*

Made in a variety of sizes for different localities, ranging from 20 to 75 fathoms long and from 110 to 250 meshes deep, of $2\frac{1}{4}$ to $3\frac{1}{4}$ inch mesh, of cotton gill-net twine. Mackerel gill nets are made in practically the same style mesh, $2\frac{3}{4}$ to $3\frac{3}{4}$ inch.

548. *Linen dip nets:*

Used for capture of minnows, shrimp, etc. Sizes vary from 12 to 36 inches.

549. *Cotton dip nets:*

Used for the capture of minnows, shrimp, etc.

TRAPS, POTS, AND DIP NETS.

550. *Eel pot.*

551. *Wire eel pot:*

Used by fishermen in Waquoit Bay, Massachusetts, in fishing in waters 6 to 9 feet deep. Live minnows are considered the best bait. When live bait can not be obtained, fresh fish of any kind is used. The fish is suspended in the middle of the pot by a string, which is fastened to the "backbone" which runs lengthwise of the pot.

552. *Wicker eel pot:*

Used by fishermen at Vineyard Haven, Mass., and fished in water 8 to 21 feet deep. Ballast of stones sufficient to sink the pot is used, the stones being put into both compartments. The bait is not suspended, but lies on the bottom of the pot.

Another pot made exactly like this, only from 5 to 7 feet long, is used in water 2 or 3 feet deep, generally in a narrow creek. No bait is needed with this pot, but a leader and wings, made of sticks about 15 or 18 inches long and woven with rope is used. The leader is usually 20 to 40 feet long and each of the wings is about 20 feet long. The pot when set as above really becomes a small weir.

553. *Lobster pot (rounded top):*

This style pot has been in common use in southern Massachusetts a number of years and is known as a "parlor pot." The style is peculiar (in having one end closed) to the territory south of Cape Cod. The pots used north of Cape Cod have a funnel in both ends, so that it is possible for a lobster to enter through either end. The fishermen claim that the parlor pot is preferable, as many are lost through the lower end of the double-end pot while it is being hauled to the surface. All the lobster pots require ballast to sink them to the bottom. The average ballast per pot consists of 8 bricks placed on the bottom of the pot and along the sides, and held in place by laths along the sides tied with a string. This pot is fished in water varying in depth from 10 to 200 feet. Fresh fish is considered the best bait, but when this can not be obtained salt bait is used.

554. *Lobster pot (flat top):*

This is practically the same as the other lobster pot, differing only in shape. Fishermen agree that both pots fish equally well, but are gradually discarding the rounded top for the flat top, as the latter store better in a boat when being carried to and from the fishing grounds.

555. *Lobster pot (Cohasset):*

556. *Lobster trap:*

This trap is made of slats and twine and is in more general use for capturing lobsters than any other form on the Atlantic coast.

557. *Eel pot:* Used in the capture of eels on the New England coast.

558. *Dip net.*

LINES.

559. Tub of deep-water or Grand Bank cod trawl, with anchor, buoy, black ball, and staff.
560. Tub of inshore cod trawl, including anchor, buoy, black ball, and staff.
561. Tub of haddock trawl, including anchor, buoy, black ball, and staff.
562. Skate of halibut trawl, including anchor, buoy, black ball, and staff.
563. Georges cod hand line in tub, complete.
564. Nantucket shoals or rip cod hand line.
565. Pollock hand line. This hand line is used by fishermen from the deck of a vessel for capturing pollock in inshore waters.
566. Mackerel line and jig, used in jigging for mackerel.
568. Blue-snapper line. Used in mackerel fishery with a plain hook instead of jig.
569. Squid line with jig attached. Used in catching squid for bait.
570. Smelt spreader with smelt hooks.
571. Pacific coast trawl line. Used for catching rock-fish, halibut, flounders, and other fishes from Cape Flattery to San Diego.

572. *Sturgeon set line.*

These lines are usually a mile or two in length, and are made to carry upward of of a thousand hooks. They are used on the Upper St. Lawrence and eastern end of Lake Ontario for catching sturgeon.

ANGLING EXHIBIT BY ABBEY & IMBRIE, OF NEW YORK.

Exhibit of Tackle for Sea Fishing.

Striped-bass rod, made of noibwood, two tips, short rubber butt, German-silver mountings, 7 feet long.
Tarpon rod, made of noibwood, two tips, short rubber butt, German-silver mountings, 6¼ feet long.
Split bamboo rod, for sea fishing. Two pieces, with extra tip, German-silver mountings, 7½ feet long.
Blue-fish rod, Calcutta bamboo. Two pieces, German-silver mountings, 7½ feet long.
Landing net, with steel collapsing frame and bamboo handle.
Steel gaff for tarpon and yellowtail. Patent automatic gaff.
Leather rod rest for heavy fishing.
Best quality reel for tarpon and yellowtail fishing, made of German silver and hard rubber, with Abbey & Imbrie's patent compensating steel pivot bearings.
Nickel-plated reel for tarpon and yellowtail fishing, with Abbey & Imbrie's patent compensating steel pivot bearings.
Striped-bass reel, made of German silver and hard rubber, with Abbey & Imbrie's patent compensating steel pivot bearings.
The "Imbrie" reel, made of German silver and hard rubber, with patent compensating steel pivot bearings.
Hard-rubber and nickel-plated reel for weak-fish, with patent compensating steel pivot bearings.
Nickel-plated striped-bass reel, with patent compensating steel pivot bearings.
Tarpon line on spool, made of best quality linen No. 21 thread, 600 feet long, tested to 36 pounds.
Striped-bass line on spool, made of best quality linen No. 18 thread, 300 feet long, tested to 34 pounds.
Weak-fish line on spool, made of best quality linen No. 12 thread, 150 feet long, tested to 22 pounds. (Two spools connected.)
Striped-bass line on block, made of best quality linen No. 15 thread, 300 feet long, tested to 28 pounds.
Weak-fish line on block, made of best quality linen No. 9 thread, 150 feet long, tested to 16 pounds. (Two blocks connected.)
Best quality hard braided linen line for hand fishing, 300 feet long.
Two hanks (84 feet each) best quality braided cotton line for hand fishing.
"Extra-strength" braided silk line for heavy fishing in fresh water, tested to 33 pounds, 150 feet on each block. (Two blocks connected.)
"Extra-strength" braided silk line, waterproofed, tested to 28 pounds, 75 feet on each card. (Four cards connected.)
Pocket tackle box, containing 1 striped-bass spinner, 1 pearl weak-fish squid, one-half dozen bronze forged hooks for sea fishing, 1 knit thumb stall, one-third dozen sinkers, assorted, one-third dozen swivels.
Six-swivel "dipsey" sinkers, assorted. Box lead "worm" sinkers.
One-half dozen highest quality heavy double-gut leaders, 3 feet long.

ANGLING EXHIBIT BY ABBEY & IMBRIE, OF NEW YORK—Continued.

Exhibit of Tackle for Sea Fishing—Continued.

Bronze tarpon hook snelled on phosphor bronze wire, with swivels, 30 inches long.
Bronze tarpon hook on plaited linen snell wound with wire, 36 inches long, with swivels.
Bronze tarpon hook on three links of piano wire, with swivels, 24 inches long.
One-fourth dozen blue-fish hooks on two links of piano wire, assorted sizes.
One doz. highest quality bronzed "Sproat" hooks, No. 6/0, on double "mist-color" gut.
One doz. highest quality bronzed "Sproat" hooks, No. 5/0, on 1-inch treble gut loops.
Pair aluminum fish tongs.
One-half dozen brass treble swivels, patented.
One-fourth dozen pearl weak-fish squids.
Two sea spinners.
Plain maskinonge spoon, nickel-plated.
Hammered maskinonge spoon, nickel-plated.
"Coburg" pattern maskinonge spoon, nickel-plated.
Two knit thumb stalls.
Two silver-plated fluted trolling spoons. One gold-plated fluted trolling spoon.

Exhibit of Tackle for Bait Fishing and Trolling.

Best quality eight-section split bamboo bait rod, German-silver mountings, hard-rubber butt, with extra tip and agate guides, 8¾ feet long, 9½ ounces.
Best six-strip "hexagonal" split bamboo trolling rod, German-silver mountings, hard-rubber butt, with extra tip, 10½ feet long, 12 ounces.
Six-strip hexagonal split bamboo bait-casting rod, German-silver mountings, wired cork butt, with extra tip, 8½ feet long, 9 ounces.
Six-strip hexagonal two piece split bamboo frog-casting rod, German-silver mountings, cork butt, with extra tip, 6 feet long, 5½ ounces.
Best quality noibwood bait rod, German-silver mountings, hard-rubber butt, with extra tip, 8¼ feet long, 10 ounces.
Best quality lancewood bait rod, German-silver mountings, hard-rubber butt, with extra tip, 9½ feet long, 12 ounces.
"Imbrie" reel, double multiplying, made of German silver and hard rubber, for bait fishing, with Abbey & Imbrie's patent compensating steel pivots.
Quadruple multiplying reel, German silver, with patent compensating steel pivots.
Quadruple multiplying reel, nickel-plated, with patent compensating steel pivots.
Double multiplying reel, hard rubber and nickel plate, with patent compensating steel pivots.
Double multiplying round-disk reel, nickel-plated, patent compensating steel pivots.
Double multiplying raised-pillar reel, nickel-plated, patent compensating steel pivots.
Tin tackle box for fresh-water fishing.
"Extra-strength" braided silk line on 50-yard blocks, tested to 18 pounds. (Two blocks connected.)
"Extra-strength" braided silk line, waterproofed, on 25-yard cards. (Four cards connected, tested to 12 pounds.)
Best quality braided raw-silk line, on 25-yard cards. (Four cards connected.)
Best quality braided dressed-silk bait-casting line, No. 70, on 50-yard spools. (Two spools connected.)
Best quality braided dressed-silk bait-casting line, No. 90, on 50-yard spools. (Two spools connected.)
One hundred yards best braided-linen line on blocks. (Four blocks connected, 25 yards on each block.)
Steel gaff, with jointed bamboo handle, for pickerel fishing.
One dozen highest quality single-gut leaders, 6 feet long, "mist color," for bass.
One dozen highest quality double-gut leaders, 3 feet long, "mist color," for bass.
One-half dozen swivel traces for trolling, 6 feet long, made of treble-twisted gut.
Nickel-plated, felt-lined leader box.
Three dozen highest quality "Sproat" hooks, bronzed and snelled, on treble-twisted "mist-color" gut loops, for pickerel fishing.
Three dozen highest quality "Sproat" hooks, bronzed and snelled, on double "mist-color" gut, for heavy bass fishing.
Three dozen highest quality "Sproat" hooks, bronzed and snelled on short double "mist-color" gut loops.
Three dozen highest quality "Sproat" hooks, bronzed and snelled on single "mist-color" gut.
Three dozen highest quality "Sproat" hooks, bronzed and snelled on short single "mist-color" gut loops.

ANGLING EXHIBIT BY ABBEY & IMBRIE, OF NEW YORK—Continued.

Exhibit of Tackle for Bait Fishing and Trolling—Continued.

Three silver-plated fluted trolling spoons.
Three gold-plated trolling spoons, fluted.
Three copper-plated fluted trolling spoons.
Four nickle-plated "spin easies." Three copper-plated "spin easies."
Two "American spinners."
Two silver-plated oval trolling spoons. Two copper oval trolling spoons.
One aluminum "ghost" for black bass. One aluminum "ghost" for pickerel.
Two nickel-plated bass spinners.
Single-beaded bass spinner. Double-beaded bass spinner.
One Lake Piseco pattern trolling spoon.
Four best casting spoons for black bass.
One "St. Lawrence gang," for trolling with live minnows.
One "Richards frog" gang.
One "Imbrie minnow gang," double gut, for bass fishing.
One "Seth Green minnow gang," single gut, for trout fishing.
One "Adirondack minnow gang," on treble-twisted gut, for lake-trout fishing.
Nickel-plated fishhook disgorger.
Spring balance, nickel-plated, registering up to 10 pounds.
Clearing ring, nickel-plated.
Three lead trolling keels to prevent line twisting.
One box lead "worm" sinkers.
One-half dozen "Mackinac" adjustable screw sinkers.
One dozen patent swivel sinkers, assorted. One dozen treble swivels.
Three-fourths dozen German silver connecting links.
Fish scaler and shredder.
Tube of "Wetheroil" for lubricating rod ferules.
Stick of "King's" ferule cement, waterproof.
Nickel-plated chain fish stringer.
One dozen swivel "dipsey" sinkers, assorted.

Exhibit of Tackle for Fly Fishing.

Best eight-section split bamboo fly rod for light brook fishing, German silver mountings, extra tip, sumac butt, 3 ounces, 7½ feet long.
Best eight-section split bamboo fly rod for stream fishing, German silver mountings, extra tip, sumac butt, 6 ounces, 9½ feet long.
Best six-strip hexagonal split bamboo fly rod for lake fishing, German silver mountings, extra tip, hard rubber butt, 7 ounces, 10 feet long.
Hexagonal split bamboo fly rod, German silver mountings, extra tip, cork butt wound with wire, 9½ feet long, 6½ ounces.
Hexagonal split bamboo fly rod, German silver mountings, extra tip, cork butt, 7 ounces, 10 feet long.
Noibwood fly rod, German silver mountings, extra tip, cork butt, 6½ ounces, 9¼ feet long.
Best lancewood fly rod, German silver mountings, extra tip, hard-rubber butt, 8 ounces, 9½ feet long.
Best quality enameled steel collapsing landing net, bamboo handle, and braided linen waterproof net.
German silver and hard-rubber raised pillar trout reel, single action, with balance handle and adjustable click.
German silver and hard-rubber "round disk" trout reel. Single action, with crank handle.
Aluminum "raised pillar" bass reel. Single action, with balance handle and adjustable click.
Nickle-plated "raised pillar" trout reel. Single action, with balance handle and adjustable click.
Nickle and hard-rubber "revolving disk" trout reel. Single action.
Canvas folding fish basket.
Double-tapered fly line, "luster finish," 50 yards long. Best braided silk enameled.
Single-tapered fly line, "luster finish," 25 yards long. Best braided silk enameled.
100 yard level fly line, "luster finish." Best braided silk enameled, on 25-yard cards, 4 connected.
100 yards best quality braided oiled silk fly line for bass fishing, 25 yards on a card, 4 cards connected.
One dozen "mist color" leaders. Heavy trout size. Single gut, 6 feet long.

ANGLING EXHIBIT BY ABBEY & IMBRIE, OF NEW YORK—Continued.

Exhibit of Tackle for Fly Fishing—Continued.

One doz. "mist color" leaders, "extra light" for brook fishing, single gut, 6 feet long.
One dozen "even tension" leaders, cemented joints, single gut, for heavy bass fishing, 4 feet long.
Leather fly book, celluloid leaves and patent spring clips; holds 8 dozen flies.
Aluminum fly box, with felt pads.
Tube "No Touch Em," to prevent insect bites.
Nickel spring balance, registers up to 6 pounds.
Two pins for carrying landing nets.
Three-fourths dozen chenille grubs.
One-fourth dozen "Adirondack spinners," for trolling.
Bottle rod and tackle varnish.
One-half dozen best quality patent "fluttering" trout flies, each, Lowery, Captain, Yellow May, Wilson, Imbrie, Coachman, Cowdung.
One-half dozen best quality trout flies, each, Parmachenee Belle, Rube Wood, Silver Doctor, Professor, Seth Green, Gray Palmer.

Exhibit of Salmon Tackle, Artificial Flies, and Miscellaneous.

Best eight-section round split-bamboo fly rod, gold mounted, with engraved ferules and reel seat. Butt and ferule plugs set with topaz. Solid-gold engraved reel, single action, with click.
Best eight-section salmon rod, with extra tip. Cane-wound butt and German silver mountings, 14 feet long.
Noibwood salmon rod, with extra tip, German silver mountings, 15 feet long.
German silver and hard-rubber salmon reel. Raised pillars, single action, balance handle and adjustable click and tension spring.
German silver and hard-rubber salmon reel. Round disc aluminum spool, balance handle and stationary click.
One hundred yards best braided silk, "luster" finish, enameled salmon line, on 25-yard cards, 4 cards connected.
One-half dozen best quality extra heavy salmon leaders. Heaviest single "mist color" gut, 9 feet long.
Polished steel salmon gaff.
Two rubber rod butts (for sale only on Abbey & Imbrie's rods).
Two patent adjustable locking reel bands, German silver (for sale only on Abbey & Imbrie's rods).
One dozen Greer's patent-lever fishhooks.
One dozen "Guillotine" spring hooks.
One-half dozen best quality salmon flies, each, Durham Ranger, Silver Doctor, Brown Fairy, Black Dose, Butcher, Jack Scott.
One-half dozen best quality trout flies, each, Cahill, Blue Bottle, Brown Palmer, Black Gnat, Royal Coachman, Green Drake, Grizzly King, Ibis, Dark Montreal.
One-half dozen best quality patent "fluttering" trout flies, each, Governor, Black Palmer, Abbey, Jenny Lind, Martin, Queen of Waters, White Miller, Beauty.
One-half dozen best quality trout flies, with "helpers," or reenforced gut, each, Jenny Lind, Martin, Yellow May, White Miller, Captain, St. Patrick.
One-half dozen best quality patent "fluttering" trout flies, with "helpers," or reenforced gut, each, Ibis, Silver Doctor, Parmachenee Belle, Dark Montreal, Royal Coachman, Black Gnat.
One-half dozen best quality fancy flies for lake fishing, with "helpers," or reenforced gut, each, Beatrice, Bemis Stream Finch, Le Grande, Lord Baltimore, Maine Doctor, Tinselled Ibis, Fancy Parmachenee Belle, Jack Scott, Fairy Parmachenee Beau, Wood Duck, Blue Jay, Humblebee, Holberton, Prouty, Page, Elliot.
Fancy flies for lake trout and landlocked salmon. Tied on short twisted gut loops, one-quarter dozen each, Fiery Brown, Grizzly King, Montreal, Jack Scott, Lord Baltimore, Parmachenee Belle, Professor, Royal Coachman, Silver Doctor, Tiger, Yellow Miller, Papa Hackle.
"Medallion" bass flies for trolling, 3 dozen assorted patterns.
"Weedless" bass flies for trolling in shallow water, the hook being protected by the wings, 3 dozen assorted patterns.
"Bucktail" bass flies, 1½ dozen assorted patterns.
Best quality "Midge" flies for brook fishing, 3 dozen assorted patterns.
One dozen winged bugs, for trout fishing.
One dozen artificial insects, for trout fishing

Appliances for Dredging and Seizing.

Oyster dredge:

Galvanized iron frame 34 inches wide across mouth, with net of iron mesh. This style of dredge is generally used all along the Atlantic coast, particularly in the Chesapeake Bay, on sailing vessels.

Oyster scrape:

Galvanized iron frame 34 inches wide across the mouth, with bag of cotton netting. Used along the Atlantic coast of the United States on oyster beds in shoal water and soft bottom.

Scallop dredge:

In common use in Buzzards Bay and the waters south of Cape Cod, Mass. It is operated from a sailboat and is dragged along the bottom while the boat is sailing, thus scooping up the scallops. After the dredge has been dragged along the bottom for a short time it is hauled to the surface and the contents emptied into the boat.

Clam or quahog rake:

Used at Edgartown, Mass. When rigged it has a pole 20 to 30 feet long, so that the operator can cover considerable ground without changing the position of the boat from which he works. This pole is made of yellow pine and is 2 inches square at the end joining the rake, and gradually tapers to 1 inch in diameter at the end.

Sea horse:

Used at Edgartown, Mass., for digging clams which are covered with water. The canvas strap is passed over one shoulder and under the opposite arm, and enables the operator to exert considerable force with his back and shoulders in addition to that applied with his arms. The long teeth are forced down into the sand or mud and then the whole is lifted clear of the bottom and by a peculiar motion the mud and sand are sifted through the teeth and the clams retained above the teeth and brought to the surface.

Oyster Tongs.

Marsh's improved deep-water oyster tongs, used in water 30 to 200 feet deep.

Oyster tongs:

Galvanized iron head and frame 24 inches wide with 14 iron teeth and shafts of wood 14 feet long. In common use along the Pacific coast by boatmen oystering in shallow water.

Oyster tongs:

Galvanized iron head and frame 21 inches wide with 12 iron teeth and shafts of wood 12 feet long. In common use along the Atlantic coast by boatmen oystering in shallow water.

Oyster nippers:

Frame of galvanized iron 6 inches wide. Handle 6 feet 6 inches long. Used by tongers for catching single oyster in shallow water.

Clam fork: Used in digging clams on shore.

Clam hoe: Used by fishermen in digging clams.

Deep sea oyster tongs.

Appliances used in the Sponge Fishery.

The sponge fishery is prosecuted from small boats carrying two men, from two to five boats belonging to one smack. While the boat is being managed by one man the other leans over the side and thrusts his head in the water-glass, which he holds with one hand, while with the other hand he manipulates a long-handled pole, to which is attached a three-pronged hook. When a sponge is seen growing on the bottom, it is detached with the hook and drawn to the surface. For shallow-water fishing the poles and hooks are lighter than for deeper water. The maximum depth at which sponges can be taken by this method is 52 feet.—Florida.

Whaling Apparatus.

The rocket-gun:

A stockless gun with a barrel of such shape and proportion as to balance on the shoulder of the gunner; designed to throw large rockets and shells; barrel, sheet-copper, cylindrical; two rods project behind the barrel and fastened to an iron plate; barrel encircled with two wide transverse flanges, the lower one fixed, and the upper one hinged in such a manner that when the gunner is taking aim it lies parallel to the barrel, but is thrown up vertically by the action of the rocket to protect the gunner from the "backfire" of the rocket. The gun is discharged by firing the pistol through a hole made in the stock into the rocket.

Brand gun, No. 2:

Barrel, cast-steel; front part of barrel round. Ramrod, hickory. Skeleton stock, iron. Guard-plate, steel. Rigid eye for laniard. Patent breech. Stock and barrel "browned." Length, 36 inches. Weight, 19½ pounds.

Darting-gun:

Pierce's darting-gun, old style, with pole, harpoon, and darting-bomb; muzzle-loading. Gun: Barrel, lock-case, socket for pole, socket-pieces or lugs for harpoon, and one forward guide for trigger, gun-metal; two after guides for trigger, brass; bottom of lock-case, brass, soldered; firing pin and trunnion, brass; lock-case (cover for excluding moisture), leather with brass catch. Hammer concealed in lock-case, gun-metal. Trigger projecting beyond muzzle, steel rod. Harpoon, common toggle-iron; rear end made to fit socket-pieces on the muzzle of the gun and provided with a projecting eye, in which the iron strap is made fast. Toggle branded "Macy" (manufacturer). Length of gun, 19¾ inches; length of pole, 56¼ inches; length of trigger, 34 inches; length of harpoon, 30 inches; length of darting-bomb, 15½ inches.

The California gun-harpoon:

Head, common toggle, mortised, with flaring rear barb; shank, double; wire loop, served with twine; gun-strap, whale-line. Length, 50 inches; length of toggle, 9⅝ inches.

Allen's gun-harpoon:

Four fixed barbs; shank in two sections; forward part wrought-iron, terminating in a socket, into which is fitted the rear part; provided with a fixed iron collar to be used as a "stop" for the iron strap. Rear portion of shank, wood with iron ferule. Length, 46¼ inches.

Swivel-gun harpoon:

Head, wrought iron, double-barbed; shank, malleable iron, cast; double or slotted; loop with two eyes, wire, wrapped with wire; iron thimble attached, with rope for making fast the whale line. Marked "S. Lydia." Length, 48 inches.

Pierce's darting-gun harpoon:

Head, common toggle, recessed, pivoted to end of shank; shank composed of two conjoined pieces of iron; forward end, rod-iron; rear portion, piping screwed into end of forward part; iron link, twisted, attached to middle of shank for iron-strap, whale line; button, felt; point of toggle, fractured. Length, 24½ inches.

Explosive gun-lance:

A kind of explosive lance, the record of which very little is known. Consists of two conjoined parts; the forward half or magazine malleable iron, cast with the head, which has four cutting edges; the rear section, or fuse-shaft, cast-iron, fluted on three sides for the ropes (which are placed in the gun with the lance) and attached to the bomb with a screw-joint. The rear extremity of the fluted elevations are perforated with three holes through which the strands of the rope are rove and braided. Time-fuse inclosed in fluted tubular shank. Cork shoe, or button. Length, 33 inches.

Rifled whaling-gun:

Barrel, cast-steel, nine grooves; stock, walnut; rigid eye for lanyard. Length, 38 inches. Weight, 18 pounds.

Whaleman's swivel-gun:

Barrel, stub-twist; stock, Saint Domingo mahogany; guide for taking aim, brass, extending along and screwed to barrel; elevated at rear end. Barrel fastened to stock by bolts and lugs. Breech-plug chambered and screwed into the barrel. Two nipples. Flash-pan, brass, hinged to rear of elevated sight; barrel stamped "W. Greener, maker, Birmingham, 1853." Length, 51 inches. Weight, 56 pounds.

Brown's whaling-gun:

Stock, barrel, and guard-plate, gun-metal; trigger-guard fastened to stock with three screws; rigid eye on trigger-guard for lanyard; front and rear sights; breech-plug cast with stock; stock recessed for two nipples; stock and barrel connected by a screw-joint; muzzle reinforced with a gun-metal band. Stamped "Robert Brown, New London, Conn." Length, 46 inches. Weight, 36 pounds.

Brand gun, No. 1:

Barrel, cast-steel; front part of barrel round. Elongated thimble for ramrod. Ramrod, hickory, with brass thimble and screw. Skeleton stock, iron, screwed to barrel. Guard-plate, steel. Rigid eye for lanyard. Lanyard attached. Stock and barrel "blued." Length, 38 inches. Weight, 23 pounds.

Shoulder-gun, with brass stock:

Barrel, cast-steel, octagonal. Rear and front sights. Two thimbles for ramrod. Ramrod, hickory, with brass thimble and double worm-screw. Under side of barrel grooved, for ramrod. Stock, gun-metal, cast with breech-plug and rigid eye for lanyard. Grip wrapped with marline. Lock, common percussion. Length, 35½ inches. Weight, 28 pounds.

Breech-loading whaling-gun:

Skeleton stock, cast-iron, painted black. Stock and breech-piece cast in one piece, with a small rigid eye at rear guard-plate for lanyard; barrel, steel, reinforced and screwed to the stock; breechblock, containing firing-pin, hinged to stock, and, when closed, held by a snap-spring; central-fire cartridge. Length, 33 inches. Weight, 27 pounds.

The Cunningham darting-gun:

Breech-loading hinge-gun, with harpoon, strap, and bomb-lance. Gun: Barrel, socket, breech-snap, hinge, and lugs, gun-metal. Trigger, steel rod, projecting beyond the muzzle. Lance and cartridge combined. Harpoon: Common toggle-iron. Two barbs on the toggle. Mortised head; rear end of shank made to fit the lugs of the gun. Eye for rope-strap. Toggle branded, "J. A. S." (John A. Sawyer, manufacturer). Iron-strap, whale line; one end of strap bent into the eye of harpoon and the other provided with an eye-splice, into which one end of the whale line is intended to be fastened. Length of gun, 15½ inches. Length of trigger, 21 inches. Length of harpoon, 34 inches. Length of strap, 64 inches.

Darting-gun:

Breech, brass, cast with breech-piece. Barrel, steel, screwed to the breech-piece. Rear end of the gun terminates in a conical socket, into which may be fitted the pole or handle. A vertical slot is cut through the breech for the reception of the hammer, which was pivoted and retained in its firing position by the rod or trigger. Hammer, wanting. Trigger projects over the muzzle, and moves freely back and forth in a guide near the end of the barrel. A sleeve of metal, or other suitable material, was intended to fit over the breech, or lock-case, to render it water-tight.

The harpoon is of the pattern known as the "temple-gig." Toggle, malleable cast-iron, pivoted in the cheeks of the forward end of the shank. Shank, composed of two pieces of conjoined iron; first half, wrought-iron, slotted near its rear end for the iron arm with rigid eye, to which the iron strap should be made fast, and provided with a female screw in a recess in the rear end; rear part of shank cast, and screwed to the forward half of the shank. Length of gun, 17½ inches. Length of trigger, 27½ inches. Length of gun-harpoon, 23¼ inches.

Bursted barrel of a whaleman's darting-gun:

Barrel of a darting-gun, fractured by premature explosion of a bomb-lance when darted at a whale. Brought home by a whaleman as an interesting "curio." Portion of hickory pole in the socket. Length, 10 inches.

Improved breech-loading tonite hammerless darting-gun:

This gun is an improvement over the old breech-loading darting-gun No. 2, manufactured by William Lewis, of New Bedford. It is 17½ inches long, seven-eighths of an inch bore, and is as light as is consistent with strength. It is loaded from the breech by unscrewing the barrel, and has been especially designed for Arctic whaling, but is equally effective in sperm whaling. The materials used are the same as in the old shoulder-guns, but the lock-case is entirely closed to prevent ice interfering with the action of the lock, and it will discharge the bomb under water as well as out without damage to any part of the gun.

Freeman's bomb-harpoon:

An instrument with an explosive head for killing whales. Consists of a chambered head or magazine, which, when loaded, contains a charge fully equal to three-fourths of a pound of powder; a shank with a tubular head and two small rigid barbs, and socket for the pole. The inside mechanism consists of a time fuse, which extends from the shank into the magazine, a nipple for the percussion-cap, an actuating spring, and other appliances for releasing the cock, which are concealed in the recessed head of the shank. The trigger, or lever-fluke, is fastened by a hinge-pin immediately in rear of the lance-bomb. The action of the flesh as the instrument enters the whale presses down the trigger or fluke in a line with the shank, and automatically explodes and impels the head. Reloaded by substituting new heads. Length, 40½ inches.

Pierce's darting-bomb:

A kind of explosive lance known as the "darting-bomb." Used in connection with the darting-gun for killing whales. Patented and manufactured by Capt. Eben Pierce. Length, 15½ inches.

Mason's harpoon-bomb:

Designed for improved swivel-gun. Consists of a point with three cutting edges, and cast-iron bomb, cast-iron shank with four parallel grooves on the sides, and an eye at the butt for the iron-strap. Two movable flukes are fastened with a set-screw to the forward end of the shank in rear of the bomb. Length, 31¾ inches.

Pierce's bomb-lance:

A short explosive lance, with four small metal wings, which may be used in connection with the darting-gun when the latter is used as a shoulder-gun. Length, 15½ inches.

Allen's bomb-lance:

An example of the first patented bomb-lance used by American whalemen, for which letters-patent were granted Oliver Allen, Norwich, Conn., September 19, 1846. (United States Patent Office, No. 4764.) Rare. Familiarly known to the whalemen as the broom-stick lance. Length, 42 inches.

Cunningham & Cogan's bomb-lance:

An improved bomb (with rubber feathers) and cartridge combined, used in connection with Cunningham & Cogan's breech-loading gun and Cunningham's darting-gun. Patented December 28, 1875. Length, 16¼ inches.

Kelleher's hand bomb-lance:

Consists of a lance-head, a tubular magazine, and the ordinary harpoon shank, secured to a white-ash handle. A sliding clamp attached to a wire by impact explodes the bomb by means of a common friction-primer, such as is used for discharging pieces of artillery. Socket served with marline to prevent iron-rust. Lance-strap spliced around the socket, seized to the handle in three places, and projecting through a hole at the butt. Length of lance and shank, 48¼ inches. Length of pole, 70 inches.

Brand's bomb-lance, No. 3:

Used in connection with Brand's No. 3 shoulder-gun. New model. Patented in 1879. Not much used at present. Length, 24 inches.

Improved darting-gun, bomb-lance, and cartridge combined:

This lance is for seven-eighths of an inch bore and is constructed in the same manner as the shoulder-lance, except that it has no feathers, and loads, when using powder, from the end to which the cartridge is attached.

Whaleman's hand-lance:

A lance with a short wide blade, formerly used for killing whales. Superseded by the explosive lance. Length, 68 inches.

Whale hand-lance:

A lance formerly relied upon altogether for killing whales. Length, 5¼ feet.

Whale hand-lance:

A nickel-plated hand-lance, used in giving the death wound. Length, 5¾ feet.

Toggle iron.

Seal-lance:

Long head; diamond point; common shank and socket. Manufactured by James Barton for the New London sealers. New. Length, 32½ inches.

Seal-lance:

A lance with a short shank, which may be used in killing seal or sea-elephant or walrus. Socket with an extended sleeve. Length, 28½ inches.

Seal-lance:

A lance for killing seal, sea-elephant, or walrus. Spoon-shaped head and extended sleeve or socket. Used by New Bedford sealers. Length, 24 inches.

Grappling-iron:

Used to catch the line thrown around the whale, also to anchor the boat to ice.

Boat-spade:

Used to cut hole in flukes where the line is made fast by which the whale is towed to the ship.

Cutting-spade: For cutting blubber from whale into pieces to mince.

Head-spade: Used to disjoint the head.

Throat-spade: Used to cut the throat off.

Boarding-knife: For boring hole in blubber and to make it fast for hoisting on ship.

Mincing-knife: Used in mincing blubber to try out.

Pike: Used to pitch the blubber.

Gaff: For hauling the blubber.

Blubber-hook: Used to hoist blubber on deck.

Appliances for Striking.

Sword-fish harpoon; sword-fish lance; eel spears.

Sword-fish fisherman:

Plaster cast of a sword-fish fisherman in typical clothing—that is, a coarse outing shirt unbuttoned about the neck, one sleeve rolled up part of the way to the elbow, with sou'wester on head and loose pants carelessly tucked about the top of his sea boots. He stands in the pulpit near the end of the bowsprit holding the pole of a sword-fish-harpoon in his hand as if in the act of striking a fish. The method of catching sword-fish, as practiced on the New England coast, is to steer the vessel directly for the fish, the presence of which is made known by the appearance of its tail and dorsal fin above the water's surface. When the man at the bowsprit is directly over the fish, which generally happens before the latter is frightened by the approaching vessel, the harpoon is thrown, and as the craft sails along the harpoon line is reeled out and finally let go, having a buoy at its end. Later the buoy is recovered and the fish killed and taken on board.

Appliances used in the Turtle Fishery, Florida.

Turtle-spear:

The spear is attached to a pole 12 to 16 feet long, and is thrown into the back of the turtle, the fisherman being in a boat. The turtle is drawn in and secured by means of a line attached to the spear. By this method the turtle is badly injured, and often dies from the effects of the spear wound, and can not be shipped long distances.

Turtle-pegs:

A small pointed piece of steel or brass, called a peg, is loosely fitted into a brass socket at the end of a 16-foot pole. Some pegs are 4-sided and others are rounded like the plug of a boy's top. A marline line is attached to the peg and runs to the hand of the fisherman. The peg is wedged into the socket by means of a bit of cotton cloth. When a turtle is seen in water up to 20 feet deep, the pole is hurled at it and the peg enters the back shell, and holds fast; the pole becomes detached and is subsequently picked up, and the turtle is hauled in by means of the line. The peg enters the shell one-half to 1 inch, and holds very securely, so that great force is sometimes necessary in order to extract it. The turtle is not seriously injured and is available for distant shipment alive, the slight bleeding being controlled by a pledget of tobacco. Many tortoise-shell turtles, as well as green and loggerhead turtles, are taken in this way about the Florida keys and reefs.

Fishing Accessories—Hooks.

Fish hooks of various kinds used in the mackerel fishery.
Fish hooks of various sizes and kinds used for general harbor fishing, such as cunner, flounder, etc.
Fish hooks used for pickerel fishing.
Fish hooks used in trawling for halibut.
Fish hooks: (1) For cod trawling. (2 and 3) Haddock trawling. (4, 5, and 6) Cod hand-line fishing. (7 and 8) Pollock hand-line fishing. (9 and 10) Inshore trawling.
Blue-fish hooks.
Mackerel jig.
Squid jig. The heaviest are used in tides; the lighter ones in slack water.
Blue-fish squids or hooks.

Swivels.

Snood swivels used on Georges hand lines.
Lead sinker swivels used in rip hand-line fishing.
Georges hawse swivels.
Line swivels for keeping the twist out of lines.
Patent snood swivels for Georges hand lines.
Swivel for rope hawse.
Line swivel.
"Pump" swivel, or improved snood swivel.
Improved hawse swivel.
Staff trawl buoy swivel.
Mooring-buoy swivel.
Brass haddock buoy swivels.
Improved purse-line swivel.
Trawl buoy swivels.
Halibut buoy swivel.

Leads and Sinkers.

1. Net sinker.
2. Sinker for light lines in harbor fishing or shoal water.
3. Sinker for light lines in harbor fishing or shoal water.
4. Sinker for light lines in harbor fishing or shoal water.
5. Sinker for inshore hand line, old style.
6. Sinker for inshore hand line, old style.
7. Sinker improved for shore hand-line and pollock fishing.
8. Sinker improved for shore hand-line and pollock fishing.
9. Sinker improved for shore hand-line and pollock fishing.
10. Sinker improved for rip fishing.
11. Sinker improved for rip fishing and western bank fishing.
12. Sinker improved for Georges drift fishing.
13. Sinker improved for rip fishing and western bank fishing.
14. Sinker improved for rip fishing.
15. Sinker improved for shore hand-line and pollock fishing.
16. Sinker improved for shore hand-line and pollock fishing.
17. Sinker improved for shore hand-line and pollock fishing.
18. Sinker, old style, for inshore hand-line fishing.
19. Sinker, old style, for inshore hand-line fishing.
20. Sinker, old style, for inshore hand-line fishing.
21. Sinker for light lines in harbor fishing.
22. Sinker for light lines in harbor fishing.
23. Sinker for light lines in harbor fishing.
24. Net sinkers.
25. Net sinkers.
26. Sinker for light line harbor fishing, improved.
27. Sinker, old style, for shore hand-line fishing.
28. Sinker or lead, 9 pounds, for Georges hand-line fishing.
29. Sinker or lead, 8 pounds, for Georges hand-line fishing.
30. Sounding lead, improved, having a metal fin to keep it from turning and twisting the line. The hole in the lower end, when sounding, is filled with soap to which the sand or mud at the bottom of the ocean adheres, showing the character of the bottom.
31. Old style sounding lead without the fin.

SHORE AND VESSEL ACCESSORIES.

Short-handled haddock or dory gaff. Long-handled Georges gaff.
Mackerel gaff. Iron halibut hand gaff.
Three-tined fork. Two-tined fork. One-tined fork or pew.
Three-pronged ice chopper.
Mackerel bait mill.
Squilgee.
Gob stick and killer.
Hurdy-gurdy. This is attached to the dory and is used in the halibut fishery to haul up the halibut trawls.
Cockle hammer, for breaking cockles for bait in rip fishing.
Salt scoop, used in salting fish of all kinds on the Grand Banks.
Ice scoop, used in the halibut fishery for icing halibut.
Wooden dory scoop.
Torch made of galvanized iron and used on the decks of fishing vessels while baiting up trawls and dressing fish at night.
Sticking Tommy, or candle holder: A candlestick in general use on fishing vessels which can be stuck on horizontal or perpendicular surfaces below decks.
Dummy roller: A trawl roller which is attached to the gunwale of the dory to haul trawls in shoal water.
Patent roller, used on the gunwale of the dories for hauling trawls in deep water.
Fishermen's woolen mittens, used in handling fish on the banks in winter.
Cotton mittens, used in gibbing mackerel and in general use where woolen mittens would be too warm.
Small woolen nippers, used for hand-line or single-dory fishing on the inshore grounds.
Large nippers, used for hand-line fishing on Georges Bank, haddock trawling, etc.
Rubber nippers, used for shore fishing, hand lines, etc.
Rubber bands, used for holding on mittens.
Rubber bands, used for holding the oil clothes close around the rubber boot.
Mackerel bait heaver, used for throwing bait or "chum" to toll mackerel alongside the vessels.
Soapstone boot drier, used for drying rubber boots on fishing vessels. The soapstone is heated and placed in the boot over night.
Files used for sharpening fish hooks.
Rubber finger cot used to protect the finger when cut or injured.
Tin horn used in dory in foggy weather.
Oak mallet used in the halibut fishery for pounding ice; it is preferred to anything else as the ice is pounded to almost the consistency of snow and keeps the fish in better condition than coarse ice.
Oak scrub broom, in general use on fishing vessels for scrubbing dories, decks, pens, etc., to remove blood, scales, etc., after dressing fish.
Seine needle, used for mending seines.
Sailors' palm, used for mending sails.
Curry comb, used in fish houses and markets for scaling and cleaning fish.
Mackerel jig mold, with hook in position.
Splicer, used in making cod trawls and small lines.
Splicer, used in making halibut trawls.
Mackerel bait mill.
Mackerel plow or reamer, used for cutting two cracks, one on each side of the belly of the fish, to give it the appearance of being fatter than it really is.
Halibut heading knife, used in fish-houses for cutting off the heads of halibut and large cod.
Halibut fletching knife, used for cutting from the bone the flesh which is to be salted and smoked.
Common bait knife, used for cutting up bait for cod, haddock, and other fishes.
Bait chopper, used in halibut fishery for chopping bait.
Haddock rippers, used for ripping haddock open.
Clam knife, used for opening clams for bait.
Mackerel splitting knife, used for splitting mackerel open.
Skinning knife, used in fish lofts for skinning dry fish.
Skinning hook, used in skinning lofts for removing the nape bone.
Cod throating knife, used for throating cod and other large fish.
Splitting knife, used for splitting round fresh cod in preparing them for salting.
Scraping knife, used in halibut fishery to remove flesh and blood from the backbone after cutting.
Oyster hardie: Types No. 1 and 2, made of iron, are in common use in oyster houses in Philadelphia, New York, and Baltimore. Type No. 3 is known as the Philadelphia pattern.

SHORE AND VESSEL ACCESSORIES—Continued.

Break hammer, used in oyster houses in connection with the hardie for breaking off the end of the oyster shell.
Pliers, used for opening fresh-water mussels in order to remove the pearls.
Pearl knife, used for opening and removing pearls from fresh-water mussels.
Clam knife. Clam tongs.
Culling hammers: These hammers represent the various types used for culling oysters on board vessels and in oyster houses.
Stabbing knife: Type used in Baltimore and Crisfield.
Oyster knives:
Type used in Providence, R. I.
With hook blade. Type used in Norfolk.
Straight blade. Used in Alexandria, Va.
New York patterns Nos. 1, 2, 3, 4, 5.
Sampler's knife. Plain blade.
Used in Gulf coast States. Used in New Haven.

PHOTOGRAPHS, FISHERIES SERIES.

Shore fisheries:
Pile-driver for driving pound-net stakes, Edenton, N. C.
Tarring apparatus for pound net, Edenton.
Pound-net boat, Edenton.
Laying out the seine, Albemarle Sound.
Baiting the seine, Albemarle Sound.
Pound-net boat with catch, Albemarle Sound.
Pound-net fish-houses, Edenton, N. C.
Hanging pound nets out to dry, Edenton.
Complete establishment of a pound net fisherman, Edenton.
Engine house of one of the large seines, Albemarle Sound, 2 views.
Engine house and steamboats with seines aboard, Albemarle Sound.
Pound net and steamer, Cape Cod, Mass., 2 views.
Pontoon for driving trap stakes, North Truro, Mass.
Weir of J. M. Ellis, Deer Island, Me.
Herring weir, near Eastport, Me.
Taking the fish out of a weir.
Showing character, rig, and method of mooring boats, Delaware City, Del.
Typical sturgeon boats and two pontoons upon which the fish are dressed and caviar made.
Boats, sturgeon nets drying in the background, Delaware City, Del.
Group of fishermen and implements, Delaware City.
Cat-rigged fishing boats, Nantucket.
Sailing dories and other small boats, Cape Ann, Mass.
Transferring fish from live-car to vessel, Rockport, Tex.
Taking fish from live-car, Rockport.
Chinese market, San Francisco.
Fish-cart used in New England.
Fish-house, Pensacola, Fla.
Fish market houses, Rockport, Tex.
Taking on ice preparatory to leaving.
Mending the seine.
Drying the seine on reel.

Shore fisheries—Continued.
Drying seine on board, Rockport, Tex.
Drying the seine, Biloxi, Miss.

Oyster fisheries:
Oyster canoes at wharf, Hampton, Va.
Oyster vessel entering Palox River, Washington.
Apparatus used in the oyster industry, Galveston, Tex.
Tangles used for catching star-fish.
Oyster dredges, etc., in storage, New Haven, Conn.
Oyster lugger, Chemare Camanada, La.
Oyster boat, Rockport, Tex.
Dredging for oysters, Corpus Christi Bay.
Schooner *Never Tell*, Mobile, Ala.
Unloading oysters, Lopez, La.
Load of oysters at Biloxi, Miss.
Oyster shucking at Biloxi.
Oyster house of John Dalton, Morgan City, La.
Shucking oysters, C. H. Pierson's cannery, Baltimore, Md.
Capping oyster cans, Baltimore.
Packing raw oysters, Baltimore.
View of canning room, C. H. Pierson's, Baltimore.
Shipping oyster shells for cultivated beds, New Haven, Conn.
Vessel loaded with shells for planting on artificial beds.
North Carolina oyster boats at Washington, N. C.
Oyster boats frozen in at Cambridge, Md.
Oyster steamer, New Haven, Conn.
Oyster boat ready for dredging.
Oyster shells, San Francisco Bay.
Oysters exposed at low tide, San Francisco Bay.
Fence around oyster beds, San Francisco Bay.
Tonging oysters, San Francisco Bay.
Sorting and cleaning oysters for market, San Francisco Bay.
Oyster station, San Francisco Bay.

PHOTOGRAPHS, FISHERIES SERIES—Continued.

Shad fisheries:

Steam capstan; taking in line slack, Stony Point Fishery.
Taking in quarter line slack, Stony Point Fishery.
Hauling the land end of shad seine, Moxley Point, Md.
Landing the seine, Moxley Point, Md.
Landing shad seine, Chapman's Point, Potomac River, Va.
Hauling the land end of seine, Stony Point Fishery, Va.
Hauling the land end by hand, Stony Point fishery, Va.
Stony Point seine just before landing.
"Drying up" fish in "bunt" of seine.
Preparing to boat seine, Stony Point.
Commencing to boat seine, Stony Point.
Bunting the haul prior to loading market scow, Stony Point, Va.
J. Osmond & Sons' fishing floats, Havre de Grace, Md.
Shad gill fishing camp, Susquehanna River, Md.
Potomac River shad giller and ark, Piscataway Creek.
Potomac shad-fishing camp, White House shore, Virginia.
Stony Point fishery, Potomac River.
Engine house, Stony Point fishery.

Cod fisheries:

Discharging cod from vessel.
Packing cod.
Cleaning cod, 2 views.
Cod salted in butts.
Storeroom with kenches of dry-salted cod.
Cod spread on flakes to dry, 5 views.
Cod-fishing.
Shore cod-fishing boat.
Loading salt cod on vessel.
Unloading, dressing, and splitting cod for curing, Gloucester, Mass.
Discharging salted cod.
Preparing trawls on board cod-fishing vessel.

Menhaden fisheries:

Menhaden factory, Tiverton, R. I.
Unloading the menhaden.
Dumping fish into the pens.
Interior of factory, 2 views.
Wharf at menhaden factory.

Halibut fisheries:

Unloading fresh halibut, Gloucester, Mass.
Weighing and packing fresh halibut.
Cleaning halibut.
Halibut smoking, Gloucester, Mass.
Kenches and butts of fletched halibut ready for smoking, Gloucester.
Crew of fresh-halibut schooner, Gloucester, Mass.

Mackerel fisheries:

Mackerel schooner getting under way, Gloucester, Mass.
Inspecting mackerel.
Mackerel schooner at wharf.
Mackerel canning factory, North Truro, Mass.
Canning salt mackerel, Gloucester.
Interior of mackerel cannery.

Sardine fishery:

Sardine cannery, Eastport, Me.
Sardine steamer, Eastport.
Unloading fish at cannery.
Dressing sardines, Eastport.
Sardines in baskets ready for drying.
Drying sardines, Eastport.
Racks for holding trays of sardines after baking.
Sardines cooling on the racks.
Frying sardines, Green's cannery, Eastport, Me.
Packing room of sardine cannery, Eastport.
Sealing room, men sealing cans.

Clam fisheries:

Digging clams, Little Deer Island, Maine.
Clam fishermen and dories, "T" Wharf, Boston, Mass.
Clam-shucking establishment.
Clam cannery.

Fishing vessels:

Halibut schooner *Oliver W. Holme.*.
Halibut schooner *Mildred V. Lee*, Gloucester, Mass.
Mackerel schooner *Oasis.*
Cod schooner bound out.
Beam trawler *Resolute*, Gloucester.
Fishing schooner in Boston harbor.

Views illustrating the fisheries of Alaska:

Bering Sea cod.
Bering Sea cod, showing weights and lengths.
Seining herring in Alaska.
Salmon drying by natives in Alaska, 2 views.
Driving off rejected seals, St. Paul Island.
Clubbing the seals, St. Paul Island.
Sticking seals just clubbed.
Skinning the seals.
Seal carcasses after skins are removed.
Kitovi rookery, St. Paul, Pribilof Islands.
Bachelor seals, reef rookery, Pribilof Islands, 2 views.
Hauling ground for bachelor seals, reef rookery, Pribilof Islands.
A drive for killing bachelor seals, Pribilof Islands.

PHOTOGRAPHS, FISHERIES SERIES—Continued.

Salmon fisheries:

Trap net at Hunot Point, Skagit Bay, Washington.
Crib of trap net at Demock Point, Skagit Bay.
Removing salmon from trap net, Point Roberts.
Dip-net fishing for salmon on Fraser River.
Cannery at Lake Eyak, Alaska.
Cannery at Tanglefoot Bay, Alaska.
Cannery at Orca, Alaska.
Cannery at Loring, Alaska.
Cannery Point, Point Roberts, Wash.
Karluk, Alaska.
Fish cutter in salmon cannery.
Retorts and test kettles in salmon cannery.
Filling machine in salmon cannery.
Topping machine in salmon cannery.
Soldering machine in salmon cannery.
Test kettle in salmon cannery.
Cooling room in salmon cannery.
Lacquer room in salmon cannery.
Salmon barrier, McDonald Bay, Alaska.
Salmon barrier, Redfish Bay, Alaska.
Salmon barrier, head of Nichols Bay, Alaska.
Fisherman's hut, Hessa, Alaska.
Saltery, Uganuk Bay, Alaska.

Shrimp fisheries:

Village of shrimp fishermen, Pt. San Pablo, California.
Chinese shrimp fishing junk, California.
Drying and mending nets.
Treading out dried shrimp.
Shrimp meat, baskets, nets, etc.
Winnowing machine for separating shells and meat.

Market fisheries:

Sturgeon float, Delaware City, Del.
Female sturgeon on float.
Sturgeon wharf of packing house.
Lobster pots, Greens Landing, Me.
Fishing lobster pots.

Packing houses:

Smokehouse with herring boxes in foreground.
Carrying herring to smokehouse.
Hogshead smokehouse.
Stringing fish for smoking.
Smoked Columbia River salmon.

Packing houses—Continued.

Fish-freezing plant, Detroit, Mich.
Shipping room of Cincinnati Fish and Oyster Co.
Freezing room of Cincinnati Fish and Oyster Co.
Storage room of Cincinnati Fish and Oyster Co.
Pan of frozen white-fish, Detroit, Mich.
Frozen white-fish ready for packing.

Miscellaneous:

Mending nets, Portland, Me.
Packing salt fish.
Shipping room, dry-salted fish, Gloucester, Mass.
Preparing boneless fish, Gloucester.
Drying codfish, Southwest Harbor, Me.
Splitting hake in hake house, Portland, Me.
Herring smoke-houses, fish-houses, fisherman's dwelling, and farm.
Herring smoke-houses, Lubec, Me.
Washing, draining, and flaking herring at sardine cannery, Eastport, Me.
Sardine factory, Eastport, Me.
Unloading sardines, Eastport, Me.
Herring freighter, Friendship, Me.
Pinkey bound for fishing-grounds.
Mending herring nets.
Dressing and salting mackerel on board vessel.
Fish wharf with hauls of mackerel at East Gloucester, Mass.
Salting, weighing, and packing mackerel.
Pickling and branding mackerel.
Mackerel fleet in Southwest Harbor, Maine.
Cleaning mackerel on fishing boat, Little Deer Isle, Me.
Culling mackerel, Gloucester.
Revolving brushes for cleaning mackerel, Portland, Me.
Menhaden steamer unloading, men overhauling and salting purse seines, Tiverton, R. I.
Dressing halibut on deck of schooner.
Primitive menhaden factory.
Flitches of salted halibut on flakes before going to the smoke-house, Gloucester, Mass.

PRODUCTS OF THE FISHERIES.

General classification:

A. Products used as food.
B. Products used as clothing (furs).
C. Products used in the arts and manufactures.
   1. Fertilizers.
   2. Oils and fats.
   3. Glue and isinglass.
   4. Leathers.
   5. Ivory bone and shell.
   6. Pearls and nacre, including a series illustrating the manufacture of pearl buttons from fresh-water mollusks.
   7. Sponges.

NOTE.—The material illustrating this classification was obtained chiefly through the courtesy of the firms and individuals whose names are appended.

FOOD PRODUCTS PRESERVED BY DRY-SALTING.

One box bloaters, Cromarty, National Fish Company, Boston, Mass.
One box cod, A. Booth Packing Company, Chicago, Ill.
Three boxes cod, Howard W. Spurr & Co., Boston, Mass.
Two boxes cod, Potter & Wrightington, Boston, Mass.
Six boxes cod, boneless, A. Booth Packing Company, Chicago, Ill.
Four boxes cod, boneless, B. D. Snow & Co., Boston, Mass.
One box cod, boneless, Consumers Fish Company, Gloucester, Mass.
Twelve boxes cod, boneless, John Pew & Sons, Gloucester, Mass.
Three boxes cod, boneless, National Fish Company, Boston, Mass.
Four boxes cod, boneless, Potter & Wrightington, Boston, Mass.
Three cartons cod, boneless, Lord Bros. & Co., Portland, Me.
One carton cod, boneless, Shute & Merchant, Gloucester, Mass.
Two cans cod, boneless, E. T. Russell & Co., Boston, Mass.
One carton cod, boneless, Harvey C. Smith, Gloucester, Mass.
Four cartons cod, boneless, Slade, Gorton & Co., Gloucester, Mass.
One box cod, boneless, Georges, Harvey C. Smith, Gloucester, Mass.
Twenty-five boxes cod, boneless, Georges, Shute & Merchant, Gloucester, Mass.
Three cartons cod, boneless, Georges, Shute & Merchant, Gloucester, Mass.
One box cod, boneless, Georges, Slade, Gorton & Co., Gloucester, Mass.
One carton cod, boneless, Georges, Harvey C. Smith, Gloucester, Mass.
Two boxes cod, boneless, Georges, National Fish Company, Boston, Mass.
Four boxes cod, boneless, Howard W. Spurr & Co., Boston, Mass.
Three boxes cod, boneless, Potter & Wrightington, Boston, Mass.
Eight boxes cod, boneless, Lord Bros. & Co., Portland, Me.
Nine cartons cod, boneless, Lord Bros. & Co., Portland, Me.
Two boxes cod, boneless, Knowles Freeman Fish Company, Boston, Mass.
Two cartons cod, desiccated, Union Fish Company, San Francisco, Cal.
One box cod, extra choice, National Fish Company, Boston, Mass.
One carton cod, fibered, Shute & Merchant, Gloucester, Mass.
One can cod, fibered, Shute & Merchant, Gloucester, Mass.
One box codfish-ball stock, Consumers' Fish Company, Gloucester, Mass.
One box cod, Georges, Crown Packing Company, Gloucester, Mass.
Two boxes cod, Georges, John Pew & Sons, Gloucester, Mass.
One box cod, Georges, National Fish Company, Boston, Mass.
Two boxes cod, Georges, middles, A. Booth Packing Company, Chicago, Ill.
Three boxes cod, Georges, selected, A. Booth Packing Company, Chicago, Ill.
Two boxes cod, selected, John Pew & Sons, Gloucester, Mass.
Eight cartons cod, selected, Lord Bros. & Co., Portland, Me.
Three boxes cod, selected, Lord Bros. & Co., Portland, Me.
Five boxes cod, shredded, J. W. Beardsley's Sons, New York, N. Y.
One box cod, table fish, Consumers' Fish Company, Gloucester, Mass.
Three cartons cod, tablets and cream, John Pew & Sons, Gloucester, Mass.
Two cartons cod, waffle, Shute & Merchant, Gloucester, Mass.
One box haddock, finnan haddie, National Fish Company, Boston, Mass.
One can haddock, finnan haddie, National Fish Company, Boston, Mass.
Two boxes haddock, finnan haddie, A. Booth Packing Company, Chicago, Ill.
One box halibut, boneless, California Fish Company, Los Angeles, Cal.
Three cartons herring, boneless, Potter & Wrightington, Boston, Mass.
Two cartons pollock, Lord Bros. & Co., Portland, Me.
One box pollock, boneless, Lord Bros. & Co., Portland, Me.

Food Products Preserved by Smoking.

One box bloaters, smoked, John Pew & Sons, Gloucester, Mass.
Two cans carp, silver, smoked, Max Ams, New York, N. Y.
One can eels, smoked, William Haaker Company, New York, N. Y.
Two cans eels, smoked, Max Ams, New York, N. Y.
One box halibut, smoked, Consumers' Fish Company, Gloucester, Mass.
One box halibut, smoked, Crown Packing Company, Gloucester, Mass.
One carton halibut, smoked, Lord Bros. & Co., Portland, Me.
One carton halibut, smoked, chipped, G. S. Parker & Co.
One jar halibut, smoked, luncheon, H. C. Smith.
Two boxes halibut, smoked, John Pew & Sons, Gloucester, Mass.
Three packages herring, boneless, smoked, J. W. Beardsley's Sons, New York, N. Y.
One can herring, boneless, smoked, Max Ams, New York, N. Y.
Two boxes herring, smoked, Lord Bros. & Co., Portland, Me.
Two boxes herring, Potomac roe (alewives), Henry Thompfordt, Washington, D. C.
Two cans pickerel, smoked, Max Ams, New York, N. Y.
Two cans salmon, lake, smoked, Buckeye Fish Company, Cleveland, Ohio.
Two cans sturgeon, smoked, Max Ams, New York, N. Y.
Two cans sturgeon, smoked, in tomato sauce, Buckeye Fish Co., Cleveland, Ohio.
Two cans trout, lake, smoked, Max Ams, New York, N. Y.
Five boxes lake fishes, various, Wolverine Fish Company, Detroit, Mich.

Food Products Pickled in Brine.

Two cans anchovies, William Haaker Company, New York, N. Y.
Three cans caviar, prime Russian, William Haaker Company, New York, N. Y.
Ten cans caviar, prime Russian, Max Ams, New York, N. Y.
Four cans caviar, Russian, William Haaker Company, New York, N. Y.
Eight cans caviar, Russian, Max Ams, New York, N. Y.
One barrel ciscoes, A. Booth Packing Company, Chicago, Ill.
Two cans cod, corned, Burnham & Merrill, Portland, Me.
One kit cod, pickled, B. D. Snow & Co., Boston, Mass.
Two kits cod tongues, B. D. Snow & Co., Boston, Mass.
One kit cod tongues and sounds, Knowles Freeman Fish Company, Boston, Mass.
One kit cod tongues and sounds, Potter & Wrightington, Boston, Mass.
One kit halibut fins, Potter & Wrightington, Boston, Mass.
One kit halibut fins, B. D. Snow & Co., Boston, Mass.
One pail herring, lake, Buckeye Fish Company, Cleveland, Ohio.
One kit herring, split, Potter & Wrightington, Boston, Mass.
One kit herring, split, B. D. Snow & Co., Boston, Mass.
Two kits herring, various brands, Knowles Freeman Fish Company, Boston, Mass.
Four kits mackerel B. D. Snow & Co., Boston, Mass.
Four kits mackerel, National Fish Company, Boston, Mass.
Seven kits mackerel, No. 2, Knowles Freeman Fish Company, Boston, Mass.
Two kits mackerel, bloater, Knowles Freeman Fish Company, Boston, Mass.
Five kits mackerel, mess, Consumers' Fish Company, Gloucester, Mass.
Two cans mackerel, mess, Consumers' Fish Company, Gloucester, Mass.
Five boxes mackerel, mess, Consumers' Fish Company, Gloucester Mass.
Six kits mackerel, mess, Potter & Wrightington, Boston, Mass.
One pail pickerel, No. 1, A. Booth Packing Company, Chicago, Ill.
One and one-quarter barrels pickerel, No. 1, Buckeye Fish Company, Cleveland, Ohio.
One pail pickerel, No. 2, Buckeye Fish Company, Cleveland, Ohio.
Two cans roe (new caviar), Buckeye Fish Company, Cleveland, Ohio.
Two cans roe, salted from lake-fish eggs, Buckeye Fish Company, Cleveland, Ohio.
Two pails roe, shad, salt, Potomac, Henry Thompfordt, Washington, D. C.
One pail salmon, Columbia River, A. Booth Packing Company, Chicago, Ill.
One kit salmon, mess, Potter & Wrightington, Boston, Mass.
One kit salmon trout, Potter & Wrightington, Boston, Mass.
One kit salmon trout, B. D. Snow & Co., Boston, Mass.
Three cans sardellen, William Haaker Company, New York, N. Y.
Six cans sardellen, Max Ams, New York, N. Y.
One pail shad, salt, Potomac, Henry Thompfordt, Washington, D. C.
One pail trout, No. 1, A. Booth Packing Company, Chicago, Ill.
One and one-fourth barrels trout, No. 1, Buckeye Fish Company, Cleveland, Ohio.
One pail white-fish, No. 1, A. Booth Packing Company, Chicago, Ill.
One barrel white-fish, No. 1, A. Booth Packing Company, Chicago, Ill.
One barrel white-fish, "family," A. Booth Packing Company, Chicago, Ill.
One pail white-fish, "family," A. Booth Packing Company, Chicago, Ill.
One pail white-fish, "family," Buckeye Fish Company, Cleveland, Ohio.
Two pails white-fish, Wolverine Fish Company, Detroit, Mich.

Food Products Pickled in Vinegar.

Two cans eels, pickled in jelly, William Haaker Company, New York, N. Y.
Four cans eels, pickled in jelly, Max Ams, New York, N. Y.
One pail herring, spiced, A. Booth Packing Company, Chicago, Ill.
Two cans herring (Russian sardines), in spices, Max Ams, New York, N. Y.
One keg herring (Russian sardines), William Haaker Company, New York, N. Y.
One pail herring (Russian sardines), William Haaker Company, New York, N. Y.
Two cans lake shad, Buckeye Fish Company, Cleveland, Ohio.
Eight cans mackerel in souse, W. Underwood Company, Boston, Mass.
Four cans mackerel soused, California Fish Company, Los Angeles, Cal.
One box mackerel soused, California Fish Company, Los Angeles, Cal.
Two cans mackerel soused, Potter & Wrightington, Boston, Mass.
Two cans mackerel soused, E. T. Russell & Co., Boston, Mass.
Two cans mackerel soused, Sea Coast Packing Company, Chicago, Ill.
Two cans sardines spiced in souse, W. Underwood Company, Boston, Mass.
Two cans shrimp, pickled, E. T. Russell & Co., Boston, Mass.

Food Products Canned in Oil.

Two cans sardines, William Haaker Company, New York, N. Y.
Two cans sardines, De Long & Seaman, Boston, Mass.
Sixteen cans sardines, Sea Coast Packing Company, Chicago, Ill.
Ten cans sardines, W. Underwood Company, Boston, Mass.
Four cans sardines, Grady & Co., Eastport, Me.
Two cans sardines, E. T. Russell & Co., Boston, Mass.
Fourteen cans sardines, California Fish Company, Los Angeles, Cal.

Food Products Canned with Spices, Sauces, Vegetables, etc.

Two cans codfish balls, Shute & Merchant, Gloucester, Mass.
Four cans codfish balls, Potter & Wrightington, Boston, Mass.
Two cans crab meat, deviled, Barataria Canning Company, Biloxi, Miss.
Four cans crabs, deviled, McMenamin & Co., Hampton, Va.
One can herring, Bismarck in spices, William Haaker Company, New York, N. Y.
One can herring, kippered, De Long & Seaman, Boston, Mass.
One can herring, rollmops in senf sauce, William Haaker Company, New York, N. Y.
Two cans mackerel in mayonnaise, E. T. Russell Company, Boston, Mass.
Four cans mackerel in mustard, California Fish Company, Los Angeles, Cal.
One can mackerel in mustard, Grady & Co., Eastport, Me.
Two cans mackerel in mustard, Potter & Wrightington, Boston, Mass.
Eight cans mackerel in mustard, W. Underwood & Co., Boston, Mass.
Four cans mackerel in tomato sauce, California Fish Company, Los Angeles, Cal.
Two cans mackerel in tomato sauce, Potter & Wrightington, Boston, Mass.
Two cans mackerel in tomato sauce, E. T. Russell Company, Boston, Mass.
Eight cans mackerel in tomato sauce, W. Underwood & Co., Boston, Mass.
One can oysters, spiced, Martin Wagner Company, Baltimore, Md.
Two cans rock bass in tomato sauce, Buckeye Fish Company, Cleveland, Ohio.
Four cans sardines in mayonnaise, E. T. Russell Company, Boston, Mass.
Three cans sardines in mustard, Grady & Co., Eastport, Me.
Four cans sardines in mustard, Sea Coast Packing Company, Chicago, Ill.
Two cans sardines in mustard, W. Underwood & Co., Boston, Mass.
Two cans sardines in tomato sauce, Sea Coast Packing Company, Chicago, Ill.
Two cans sardines in tomato sauce, W. Underwood Company, Boston, Mass.
Two cans sardines, spiced, Sea Coast Packing Company, Chicago, Ill.
Two cans seaquad, spiced, Sea Coast Packing Company, Chicago, Ill.
Two cans trout, speckled, in tomato sauce, Buckeye Fish Company, Cleveland, Ohio.
Two cans white-fish roe in tomato sauce, Buckeye Fish Company, Cleveland, Ohio.

Food Products Canned Plain.

Two cans ciscoes, Buckeye Fish Company, Cleveland, Ohio.
Three cans clams, Burnham & Merrill, Portland, Me.
One can clams, De Long & Seaman, Boston, Mass.
Two cans clams, fresh, Potter & Wrightington, Boston, Mass.
Two cans clams, fresh, Little Neck, E. T. Russell & Co., Boston, Mass.
Two cans clams, fresh, Little Neck, Sea Coast Packing Company, Chicago, Ill.
Six cans clams, Little Neck, W. Underwood Company, Boston, Mass.
One can clams, lunch, Burnham & Merrill, Portland, Me.

FOOD PRODUCTS CANNED PLAIN—Continued.

One can clams, lunch, A. H. Bailey, Boston, Mass.
Four cans crab meat, fresh, McMenamin & Co., Hampton, Va.
Two cans green turtle meat, A. Booth Packing Company, Chicago, Ill.
Two cans herring, fresh, Sea Coast Packing Company, Chicago, Ill.
Two cans lobsters, Burnham & Merrill, Portland, Me.
Four cans lobsters, De Long & Seaman, Boston, Mass.
Two cans lobsters, fresh, W. Underwood Company, Boston, Mass.
Six cans lobsters, fresh, Paul Taylor Brown Company, New York, N. Y.
Four cans lobsters, fresh, E. T. Russell & Co., Boston, Mass.
Three cans lobsters, lunch, Burnham & Merrill, Portland, Me.
Two cans mackerel, fresh, Burnham & Merrill, Portland, Me.
Two cans mackerel, shore, John Pew & Sons, Gloucester, Mass.
Two cans oysters, black diamond brand, A. Booth Packing Company Chicago, Ill.
Two cans oysters, cove, Martin Wagner Company, Baltimore, Md.
Ten cans oysters, fresh, A. Booth Packing Company, Chicago, Ill.
Two cans oysters, fresh, cove, Barataria Canning Company, Biloxi, Miss.
Four cans oysters, Louisiana cove, G. W. Dunbar's Sons, New Orleans, La.
Four cans oysters, lunch, Martin Wagner Company, Baltimore, Md.
Three cans oysters, Milford Haven, Martin Wagner Company, Baltimore, Md.
Two cans prawns, A. Booth Packing Company, Chicago, Ill.
Ten cans salmon, A. Booth Packing Co., Chicago, Ill.
Five cans salmon, fresh, Alaska Fisherman's Packing Company, Portland, Oreg:
Seventy-five cans salmon, fresh, Columbia River Packers' Association, Astoria, Oreg.
Twelve cans salmon, fresh, Everding & Farrell, Portland, Oreg.
Twenty-two cans salmon, fresh, J. G. Megler & Co., Brookfield, Wash.
Six cans salmon, fresh, Potter & Wrightington, Boston, Mass.
Two cans salmon, fresh, Southern Oregon Improvement Company, Portland, Oreg.
Ten cans salmon, fresh, Union Fisherman's Cooperative Packing Co., Astoria, Oreg.
Twelve cans salmon, fresh, Warren Packing Company, Portland, Oreg.
Forty-eight cans salmon, Alaska Packers' Association, San Francisco, Cal.
One can salmon, Bristol Packing Company, San Francisco, Cal.
Four cans salmon, G. W. Hume, San Francisco, Cal.
Three cans salmon, R. D. Hume, San Francisco, Cal.
Eight cans salmon, Hume Bros. & Hume, San Francisco, Cal.
Four cans salmon, L. A. Pederson & Naknek Packing Company, San Francisco, Cal.
Twenty-four cans salmon, Sacramento River Packers' Assoc., San Francisco, Cal.
Two cans shrimps, fresh, Barataria Canning Company, Biloxi, Miss.
Eight cans shrimps, fresh, G. W. Dunbar's Sons, New Orleans, La.
Four cans shrimps, fresh, E. T. Russell & Co., Boston, Mass.
Twenty-two boxes lake fishes, various, Wolverine Fish Company, Detroit, Mich.
Fifteen boxes salt-water fishes, various, Wolverine Fish Company, Detroit, Mich.

SOUPS, CHOWDERS, EXTRACTS, ETC.

Two bottles clam bouillon, E. S. Burnam Company, New York.
Three cans clam broth, Franco-American Food Company, New York, N. Y.
Three bottles clam broth, E. S. Burnam Company, New York.
Two cans clam chowder, E. S. Burnam Company, New York.
One can clam chowder, Burnham & Merrill, Portland, Me.
Six cans clam chowder, Curtice Brothers, Rochester, N. Y.
Three cans clam chowder, Franco-American Food Company, New York, N. Y.
Two cans clam chowder, Potter & Wrightington, Boston, Mass.
Two cans clam chowder, W. Underwood Company, Boston, Mass.
One can clam juice, E. S. Burnam Company, New York.
One can clam juice, Burnham & Merrill, Portland, Me.
Three cans green turtle, clear, Franco-American Food Company, New York, N. Y.
Six cans green turtle soup, Curtice Brothers, Rochester, N. Y.
Three cans green turtle, thick, Franco-American Food Company, New York, N. Y.
Three cans terrapin, Franco-American Food Company, New York, N. Y.
Six cans terrapin soup, Curtice Brothers, Rochester, N. Y.
Four cans clam extract, Arthur H. Bailey, Boston, Mass.
One can fish-ball stock, Consumers' Fish Company, Gloucester, Mass.

MISCELLANEOUS.

Ten jars salmon eggs, prepared for bait, Charles R. Gatchet & Co.
Ten cakes abalone meat, dried by Chinese in San Francisco, U. S. Fish Commission.

PRODUCTS OF THE FISHERIES—USED AS CLOTHING (FURS).

Seal skin, dressed, showing method of preparation for manufacture, one-third natural; one-third plucked; one-third plucked and dyed. C. C. Shayne, N. Y.
Seal skin, dressed, plucked, and dyed, ready for manufacture. C. C. Shayne, N. Y.
Beaver skin, dressed, natural, C. C. Shayne, New York, N. Y.
Beaver skin, dressed, plucked, C. C. Shayne, New York, N. Y.
Beaver skin, dressed, plucked, and dyed, C. C. Shayne, New York, N. Y.
Otter skin, dressed, natural, C. C. Shayne, New York, N. Y.
Otter skin, dressed, plucked, C. C. Shayne, New York, N. Y.
Otter skin, dressed, plucked, and dyed, C. C. Shayne, New York, N. Y.
Hair seal skin, dressed, natural, C. C. Shayne, New York, N. Y.
Wool seal skin, dressed, natural, C. C. Shayne, New York, N. Y.
Sea otter skin, dressed, natural (sample), U. S. Fish Commission.
Mink skin, dressed, natural, U. S. Fish Commission.
Muskrat skin, dressed, natural, U. S. Fish Commission.

PRODUCTS OF THE FISHERIES—FERTILIZERS.

Tobacco starter, Russia Cement Company, Gloucester.
Essex special tobacco manure, Russia Cement Company, Gloucester.
Essex corn fertilizer, Russia Cement Company, Gloucester.
Essex complete manure, Russia Cement Company, Gloucester.
Essex complete manure for corn, grain, and grass, Russia Cement Company, Gloucester.
Essex market, garden, and potato manure, Russia Cement Company, Gloucester.
Essex A1 superphosphate, Russia Cement Company, Gloucester.
Essex XXX fish and potash, Russia Cement Company, Gloucester.
Essex ground fish skins, Russia Cement Company, Gloucester.
Essex ground fish bone, Russia Cement Company, Gloucester.
Essex dry ground fish, Russia Cement Company, Gloucester.
Essex extra fine ground fish, Russia Cement Company, Gloucester.
Menhaden fish scrap, Chesapeake Bay, 1900, platform dried, Struven & Wacker, Baltimore.
Menhaden fish scrap, Chesapeake Bay, 1900, unground, Struven & Wacker, Baltimore.
Menhaden fish scrap, Chesapeake Bay, 1900, machine ground, Struven & Wacker, Baltimore.
(Analysis of the above: Ammonia, 11 to 12 per cent; bone phosphate, 15 to 18 per cent; moisture, 6 to 8 per cent.)
Fish scrap or tankage, lake fishes, Buckeye Fish Company.
King-crab meal, United States Fish Commission.
Salmon scrap, Challenge Glue Company, San Francisco.
Codfish scrap, Challenge Glue Company, San Francisco.
Salmon guano, Alaska Oil and Guano Company, San Francisco.
Herring guano, Alaska Oil and Guano Company, San Francisco.
Salmon eggs fertilizer, Alaska Oil and Guano Company, San Francisco.
Fish fertilizer, herring, W. P. Fuller, Portland, Oreg.
Fish fertilizer, Dodd & Co., Gloucester, Mass.

PRODUCTS OF THE FISHERIES—OILS AND FATS.

Black-fish oil, natural, W. F. Nye, New Bedford, Mass.
Black-fish oil, bleached, W. F. Nye, New Bedford, Mass.
Black-fish-head oil, W. F. Nye, New Bedford, Mass.
Cod-liver oil, crude, for tanner's use, W. F. Nye, New Bedford, Mass.
Cod-liver oil, for medicinal use, W. F. Nye, New Bedford, Mass.
Dog-fish-liver oil, W. F. Nye, New Bedford, Mass.
Herring oil, W. F. Nye, New Bedford, Mass.
Menhaden oil, brown pressed, W. F. Nye, New Bedford, Mass.
Menhaden oil, bleached, W. F. Nye, New Bedford, Mass.
Ocean-sun-fish oil, W. F. Nye, New Bedford, Mass.
Porpoise oil, natural, W. F. Nye, New Bedford, Mass.
Porpoise oil, bleached, W. F. Nye, New Bedford, Mass.
Porpoise-jaw oil, W. F. Nye, New Bedford, Mass.
Porpoise or puffing-pig oil, W. F. Nye, New Bedford, Mass.
Sperm oil, natural, W. F. Nye, New Bedford, Mass.
Sperm oil, bleached, W. F. Nye, New Bedford, Mass.
Sperm oil, winter, bleached, W. F. Nye, New Bedford, Mass.

PRODUCTS OF THE FISHERIES—OILS AND FATS—Continued.

Sea-elephant oil, natural, W. F. Nye, New Bedford, Mass.
Sea-elephant oil, bleached, W. F. Nye, New Bedford, Mass.
Seal oil, W. F. Nye, New Bedford, Mass.
Shark oil, W. F. Nye, New Bedford, Mass.
Sturgeon oil, W. F. Nye, New Bedford, Mass.
Sword-fish oil, W. F. Nye, New Bedford, Mass.
Torpedo or cramp-fish-liver oil, W. F. Nye, New Bedford, Mass.
Walrus oil, W. F. Nye, New Bedford, Mass.
Whale oil, winter, natural, W. F. Nye, New Bedford, Mass.
Whale oil, winter, bleached, W. F. Nye, New Bedford, Mass.
Whale oil, Arctic bowhead, W. F. Nye, New Bedford, Mass.
Cod-liver oil, finest crude, Lofoden, Scott & Bowne, New York.
Cod-liver oil, finest nonfreezing, Lofoden, Scott & Bowne, New York.
Cod-liver oil, finest crude, Finmarken, Scott & Bowne, New York.
Cod-liver oil, finest nonfreezing, Finmarken, Scott & Bowne, New York.
Cod-liver oil, crude, Aalsund, Scott & Bowne, New York.
Cod-liver oil, nonfreezing, Aalsund, Scott & Bowne, New York.
Cod-liver oil, natural light, Scott & Bowne, New York.
Cod-liver oil, natural brown, Scott & Bowne, New York.
Cod-liver oil, medicinal natural, Scott & Bowne, New York.
Cod-liver oil, medicinal nonfreezing, Scott & Bowne, New York.
Cod-liver oil, crude, Dodd & Co., Gloucester, Mass.
Cod-liver oil, refined, Dodd & Co., Gloucester, Mass.
Cod-liver oil, medicinal crude, Dodd & Co., Gloucester, Mass.
Cod-liver oil, medicinal refined, Dodd & Co., Gloucester, Mass.
Menhaden oil, crude, Dodd & Co., Gloucester, Mass.
Menhaden oil, refined, Dodd & Co., Gloucester, Mass.
Menhaden oil, bleached, Dodd & Co., Gloucester, Mass.
Sperm oil, crude, Dodd & Co., Gloucester, Mass.
Sperm oil, refined, Dodd & Co., Gloucester, Mass.
Whale oil, crude, Dodd & Co., Gloucester, Mass.
Whale oil, refined, Dodd & Co., Gloucester, Mass.
Turtle oil.
Black-fish melon oil, D. C. Stull, Provincetown, Mass.
Cod-liver oil, medicinal, D. C. Stull, Provincetown, Mass.
Porpoise-jaw oil, D. C. Stull, Provincetown, Mass.
Porpoise oil, D. C. Stull, Provincetown, Mass.
Menhaden oil, crude, 1900, Struven & Wacker, Baltimore, Md.
Menhaden oil, light, 1900, Struven & Wacker, Baltimore, Md.
Menhaden oil, extra light, 1900, Struven & Wacker, Baltimore, Md.
Fish oil, crude, Buckeye Fish Company, Cleveland, Ohio.
Fish oil, crude, dark, Buckeye Fish Company, Cleveland, Ohio.
Fish oil, zero test, Buckeye Fish Company, Cleveland, Ohio.
Fish oil, refined, Buckeye Fish Company, Cleveland, Ohio.
Herring oil, crude, W. P. Fuller & Co., Portland, Oreg.
Herring oil, clear, W. P. Fuller & Co., Portland, Oreg.
Cod-liver oil, Alaska Codfish Company, San Francisco, Cal.
Herring oil, Alaska Oil and Guano Company, San Francisco, Cal.
Cod-liver oil, McCollom Fishing and Trading Company, San Francisco, Cal.
Spermaceti, crude, W. F. Nye, New Bedford, Mass.
Spermaceti, refined, W. F. Nye, New Bedford, Mass.
Whale-oil soap, W. F. Nye, New Bedford, Mass.
Whale-oil stearin, W. F. Nye, New Bedford, Mass.
Stearin, W. P. Fuller & Co., Portland, Oreg.
Porpoise-jaw and black-fish melon oil, for clocks, New Bedford Oil Company, Boston.
Porpoise-jaw and black-fish melon oil, for typewriters, New Bedford Oil Co., Boston.
Porpoise-jaw oil, for chronometers, New Bedford Oil Company, Boston.
Porpoise-jaw oil, for watches, New Bedford Oil Co., Boston.

PRODUCTS OF THE FISHERIES—GLUES AND ISINGLASS.

Fish glue, 653 S., used in manufacture of shoe stains and dressings, Russia Cement Company, Gloucester.
Fish glue, for household use, Russia Cement Co., Gloucester.
Fish glue, for woodwork, mechanics' use, Russia Cement Co., Gloucester.
Fish glue, for photo-engraving on zinc and copper, Russia Cement Co., Gloucester.
Fish glue, for use by envelope manufacturers, Russia Cement Co., Gloucester.
Fish glue, bleached, used for sizing white straw goods, Russia Cement Co.
Fish glue, unbleached, used for sizing colored straw goods, Russia Cement Co.
Fish glue, wool sizing, used in manufacture of fine woolen goods, Russia Cement Co.
Fish glue, 692 F. H., used in the manufacture of shoes, Russia Cement Co.
Fish glue, O. C., used in the manufacture of table oilcloths, Russia Cement Co.
Fish glue, 111, used in the manufacture of gummed paper, Russia Cement Co.
Fish glue, 660, used by manufacturers of adhesive plasters, Russia Cement Co.
Fish glue, colored, used by printers and bookbinders for "blocking," Russia Cement Co., Gloucester.
Fish glue, belting cement, used in the manufacture of leather belting, Russia Cement Co., Gloucester.
Fish glue, dried, for general purposes, Russia Cement Co., Gloucester.
Fish glue, No. 1, Dodd & Co., Gloucester.
Fish glue, No. 2, Dodd & Co., Gloucester.
Fish glue, No. 3, Dodd & Co., Gloucester.
Fish glue, Challenge Glue Company, San Francisco.
Fish glue, sheet, from fresh-water fish (2 packages), Buckeye Fish Company, Cleveland.
Fish glue, sheet (isinglass), from fresh-water fish (2 packages), Buckeye Fish Co.
Fish glue, sheet (gelatine), from fresh-water fish (1 package), Buckeye Fish Co.
Fish glue, sheet, from haddock skins, United States Fish Commission.
Fish glue, sheet, from pollock skins, United States Fish Commission.
Ribbon isinglass, 3 packages, L. M. Haskins, Boston.
Cusk and cod skins, used in manufacture of glue, United States Fish Commission.
Cusk and cod skins, used in manufacture of glue, Russia Cement Company, Gloucester, Mass.
Hake sounds, split, used in manufacture of isinglass, United States Fish Commission.
Cod sounds, split, used in manufacture of isinglass, United States Fish Commission.

PRODUCTS OF THE FISHERIES—LEATHERS.

Ten samples seal leather, dressed and dyed, U. S. Fish Commission.
Seven samples walrus leather, dressed and dyed, U. S. Fish Commission.
Six samples sea-lion leather, dressed, U. S. Fish Commission.
One sample sea-lion leather, tanned, U. S. Fish Commission.
One sample manatee leather, dressed, U. S. Fish Commission.
One sample whale leather, U. S. Fish Commission.
One water-snake skin (*Acrochordus javanicus*), tanned and dressed, U. S. Fish Commission.
One beaver-tail skin, tanned and dressed, U. S. Fish Commission.
One wolf-fish skin, tanned and dressed, U. S. Fish Commission.
One seal skin, split and grained, U. S. Fish Commission.
One frog skin, tanned and dressed, U. S. Fish Commission.
One gar skin, U. S. Fish Commission.
One sturgeon skin (Japanese), U. S. Fish Commission.
Two dog-fish skins (Japanese), U. S. Fish Commission.
Two samples seal skin, tanned and dyed, Kaufher & Co., Newark, N. J.
One sample shagreen of shark skin, Kaufher & Co., Newark, N. J.
One sample porpoise leather, Kaufher & Co., Newark, N. J.
One seal skin, tanned and dyed, Kaufher & Co., Newark, N. J.
One ray skin, Kaufher & Co., Newark, N. J.
One alligator back, tanned and dressed, Kaufher & Co., Newark, N. J.
One alligator claw, tanned and dressed, Kaufher & Co., Newark, N. J.
One alligator belly, tanned and dressed, Kaufher & Co., Newark, N. J.
One alligator belly, tanned and dressed, A. F. Bertin, New York, N. Y.

PRODUCTS OF THE FISHERIES—IVORY, BONE, AND SHELL.

Specimens of ivory:

One narwhal tusk, U. S. Fish Commission.
Two walrus tusks, 15 pounds, U. S. Fish Commission.
Two walrus tusks, U. S. Fish Commission.
Two walrus tusks, scrimshawed, U. S. Fish Commission.
Two sperm-whale tusks, U. S. Fish Commission.
Two sperm-whale tusks, U. S. Fish Commission.
One sperm-whale tusk, scrimshawed, U. S. Fish Commission.
One sperm-whale tusk, scrimshawed, U. S. Fish Commission.
One sperm-whale tusk, scrimshawed, U. S. Fish Commission.
One lower jaw of sperm-whale with teeth, U. S. Fish Commission.
One lower jaw of sperm-whale, scrimshawed, U. S. Fish Commission.
Nine alligator teeth, rough and polished, U. S. Fish Commission.

Specimens of whalebone:

Section of baleen from mouth of finback whale, U. S. Fish Commission.
Two slabs of baleen from mouth of right whale, U. S. Fish Commission.
One whalebone back supporter, U. S. Fish Commission.
One piece of baleen, U. S. Fish Commission.
One whalebone rule, U. S. Fish Commission.
One lot whalebone, U. S. Fish Commission.
One lot shredded baleen, U. S. Fish Commission.
One coil baleen, U. S. Fish Commission.
Three lots whalebone strips, U. S. Fish Commission.
One lot whalebone strips, U. S. Fish Commission.
One whalebone divining rod, U. S. Fish Commission.
One whalebone cane, U. S. Fish Commission.
One whalebone cane, U. S. Fish Commission.

Specimens of shell:

Hawksbill turtle, stuffed and mounted, with polished shell, U. S. Fish Commission.
Tortoise shell, rough (Philippines), U. S. Fish Commission.
One back plate of tortoise shell, partly polished, U. S. Fish Commission.
One belly plate of tortoise shell, partly polished, U. S. Fish Commission
Two back plates, hawksbill, rough, U. S. Fish Commission.
Three back plates, loggerhead, rough, U. S. Fish Commission.

PRODUCTS OF THE FISHERIES—PEARLS AND NACRE.

Ninety-one valves of fresh-water pearl-bearing mussels from Mississippi Basin, polished to show nacre or mother-of-pearl.
Seven valves of fresh-water pearl-bearing mussels from Mississippi Basin, showing formation of pearls. (*Lampsilis rectus, L. ligamentinus, Quadrula ebena.*)
Seven valves of fresh-water pearl-bearing mussels from Mississippi Basin, showing irregular pearly formations or "slugs." (*Lampsilis ligamentinus, Quadrula ebena, Q. undulata.*)

Pearl-bearing fresh-water mussels, showing different colored nacre:

Two valves *Lampsilis alatus*, Mississippi River, purple nacre.
Two valves *Lampsilis rectus*, Mississippi River (Iowa), purple nacre.
Two valves *Lampsilis fallaciosus*, Mississippi River (Iowa), pink nacre.
Two valves *Lampsilis ligamentinus*, Mississippi River, pink nacre.
Two valves *Symphynota complanata*, Mississippi River (Iowa), salmon nacre.
Two valves *Symphynota costata*, Mississippi River, yellow nacre.
Seven valves *Unio crassidens*, Mississippi Basin, purple, salmon, and pink nacre.
Three valves *Unio gibbosus*, Cumberland River, Tennessee, purple nacre.
Two valves *Anodonta footiana*, Indiana lakes, salmon nacre.
One valve *Quadrula tuberculata*, Cumberland River, Tennessee, purple nacre.
Two valves pearl oyster (*Meleagrina margaritifera*), Indian Ocean.
Two valves pearl oyster (*Meleagrina*), Paumotu Archipelago, South Pacific Ocean.
Two abalone or "sea ear," *Haliotis*, southern California.
Five abalone or "sea ear," *Haliotis*, polished, southern California.
One Florida conch, *Strombas gigas.*

MUSSEL FISHERY AND PEARL-BUTTON INDUSTRY OF THE MISSISSIPPI VALLEY.

Pearl-bearing fresh-water mussels from Mississippi River:

Five valves "nigger head" (*Quadrula ebena*).
One valve "blue-point" (*Quadrula undulata*).
Four valves "yellow sand-shell" or "yellow back" (*Lampsilis anodontoides*).
Four valves "black sand-shell" (*Lampsilis rectus*).
Four valves "slough sand-shell" (*Lampsilis fallaciosus*).
Four valves "mucket" or "mouket" (*Lampsilis ligamentinus*).
Two valves "pocketbook" (*Lampsilis capax*).
One valve "pocketbook" (*Lampsilis ventricosus*).
Four valves "deerhorn" or "buckhorn" (*Tritigonia tuberculata*).
Four valves "butterfly" (*Plagiola securis*).
Two valves "hatchet back" or "hackle back" (*Symphynota complanata*).
Four valves "warty back" (*Quadrula pustulosa*).
Five valves mussel shells, distorted. Six valves mussel shells, injured.

Manufacture of buttons:

Eight valves, shells from which blanks have been cut.
Nine valves, shells with blanks only partly cut through.
Two lots rough blanks. One lot ground blanks.
One lot faced blanks. One lot shaped blanks.
One lot buttons, with eyes drilled. One lot completely polished buttons.
Twenty-four cards buttons, mounted.

Photographs illustrating button manufacturing:

Factory at Muscatine, Iowa. Sawing the rough blanks.
Saws and saw holders. Grinding the blanks.
Drilling the eyes. Sorting and sewing the buttons on cards.

Photographs illustrating apparatus and methods of fishing for fresh-water mussels:

Crowfoot dredge or grapple, showing mussels attached to the hooks.
Tongs and rake.
Steam dredging boat especially constructed for fishery.
Scow, with dredge and windlass.
Fishing through the ice with tongs and rakes (3 views).
Handling the shells on shore.
Loading the shells on scows at fishing camps for shipment to factories (3 views).

PRODUCTS OF THE FISHERIES.—FLORIDA SPONGES.

[John K. Cheney, Tarpon Springs, Fla.]

Ten velvet and wire, natural.
Four velvet, bleached.
Eight glove, natural.
Eight glove, bleached.
Nine yellow, keys, natural.
Ten yellow, gulf, natural.
Five yellow, bleached.
Seventeen wool, keys, natural.
Nine wool, gulf, natural.
Thirteen wool, bleached.
Eleven grass, keys, natural.
Eight grass, gulf, natural.
Twelve grass, bleached.
Seven assorted, bleached.
Twelve assorted (large), natural.

PRELIMINARY REPORT

ON AN

INVESTIGATION OF THE FISHES AND FISHERIES

OF THE

HAWAIIAN ISLANDS.

BY

DAVID STARR JORDAN AND BARTON WARREN EVERMANN.

NOTE.—This paper was first printed as House of Representatives Document No. 249, Fifty-seventh Congress, first session.

LETTER OF TRANSMITTAL.

To the Senate and House of Representatives:

I transmit herewith, for the information of the Congress, a communication from the Commissioner of Fish and Fisheries forwarding a preliminary report on an investigation of the fisheries and fishing laws of Hawaii, made in accordance with the provisions of the act of Congress approved April 30, 1900.

Your attention is called to the request of the Commissioner that the sum of $10,000 be appropriated for the immediate use of the Commission in carrying out the wishes of Congress.

THEODORE ROOSEVELT.

WHITE HOUSE, *January 13, 1902.*

UNITED STATES COMMISSION OF FISH AND FISHERIES,
Washington, D. C., January 7, 1902.

The PRESIDENT:

The act of Congress approved April 30, 1900, providing a government for the Territory of Hawaii, contained the following section:

SEC. 94. That the Commissioner of Fish and Fisheries of the United States is empowered and required to examine into the entire subject of fisheries and the laws relating to the fishing rights in the Territory of Hawaii, and report to the President touching the same, and to recommend such changes in said laws as he shall see fit.

In accordance therewith, I caused to be made during the past summer an investigation of the fishes, fisheries, fishery laws, etc., of the Territory. The investigation was placed under the direction of Dr. David S. Jordan, president of Leland Stanford Junior University, and Dr. Barton W. Evermann, ichthyologist of the U. S. Commission of Fish and Fisheries, whose report I have the honor to submit herewith.

This report deals especially with the question of fishery legislation, and contains a number of recommendations, to which I have given my approval, for the improvement and preservation of the local fisheries.

The report is to be regarded as preliminary. The large size of the Territory and the great extent of the available fishing-grounds make desirable further investigation of the fishery resources, particularly those of the comparatively deep waters about the islands. This investigation will be conducted during the current calendar year under the general direction of Dr. Jordan, and the Commission has already obtained your approval of the plan to assign the steamer *Albatross* to this work.

In providing for the examination of the fisheries of Hawaii, Congress made no appropriation to meet the necessary expenses. It is therefore requested that the sum of $10,000 be appropriated for the immediate use of the Commission in carrying out the wishes of Congress.

Very respectfully,

GEORGE M. BOWERS,
Commissioner.

PRELIMINARY REPORT ON AN INVESTIGATION OF THE FISHES AND FISHERIES OF THE HAWAIIAN ISLANDS.

By David Starr Jordan and Barton Warren Evermann.

We have the honor to present a preliminary report on the fish and fisheries of the Hawaiian Islands, based on investigations placed under our charge by the United States Commissioner of Fish and Fisheries. The investigations began in June, 1901, and were continued for about three months, during which time all the islands were visited. As assistants we had the services of the following: Mr. John N. Cobb, statistician, and Mr. E. L. Goldsborough, clerk and general assistant, detailed from the Fish Commission; Mr. C. B. Hudson and Mr. A. H. Baldwin, employed as artists; Mr. M. Sindo, of Stanford University, employed as preparator; and Dr. O. P. Jenkins, of Stanford University, the chief authority on the fishes of Hawaii, who accompanied the expedition as a volunteer assistant.

During the progress of these investigations many courtesies were shown us by the various Territorial officials and others, among whom we should mention specially Governor Dole and Acting Governor H. E. Cooper; Prof. W. D. Alexander, of the coast survey; Dr. J. B. Pratt, of the board of health; Mr. E. R. Stackable, collector of customs at Honolulu; Miss M. A. Burbank, librarian of the public library at Honolulu; Mr. F. G. Smith, of the Oahu Railway and Land Company; the officials of the Inter-Island Steam Navigation Company and the Wilder Steamship Company; Prof. W. T. Brigham and Mr. A. Seale, of the Bishop Museum; Mr. S. M. Damon and Mr. Jos. S. Emerson, of Honolulu; Mr. W. S. Wise, Mr. J. M. Hering, and Mr. Carl S. Smith, of Hilo; Mr. J. Storan Moloney, Mr. E. H. Bailey, and Mr. William T. Robinson, of Maui, and Hon. F. W. Beckley, of Molokai. To all of these we wish to acknowledge our obligations and express our thanks. We are also under especial indebtedness to Mr. E. L. Berndt, inspector of the market at Honolulu.

SCOPE OF THE INVESTIGATIONS.

So little being definitely known regarding the fishes and other aquatic resources of the Hawaiian Islands, it was manifestly desirable to go into the whole question of the fisheries of those islands, and to make the investigations sufficiently comprehensive and exhaustive to enable the Commission to publish, in time, a full and reliable report upon the aquatic resources of the entire group.

This would, in the first place, necessitate much work by shore parties, who would make inquiries along the following lines:

1. A qualitative and quantitative study of the commercial and shore fishes, mollusks, crustaceans, and other aquatic animals and plants. Attention would be given to the actual and relative food values and the commercial importance of the different species; the important facts in their life histories, such as their migrations, spawning time and place, food, feeding habits, enemies, and maximum and average size.

2. The methods, extent, and history of the fisheries would have to receive careful attention. The kinds of apparatus used, the manner, time, and place of using each, the species taken in each, and the manner of caring for and disposing of the catch; the statistics of the fisheries, value of each kind of apparatus, as boats, nets, traps, etc.; nature and value of shore property; nationality and number of people engaged in the fisheries; business relations and contracts between fishermen and those by whom employed; quantity and value of each species caught; prices paid the fishermen, also those received wholesale and retail; changes in methods, extent, and character of the fisheries in historic times as shown by records and traditions, particularly since the coming of Europeans and Asiatics.

3. The fishery laws would need special consideration, including an account of fishery regulations and legislation from the old system of tabu to the present time.

The possibility of improvement in the methods of taking fish and the methods of handling and marketing them should receive careful consideration, and the necessity for and possibility of fish-cultural operations with reference to species that may be in danger of extinction or serious diminution, and the introduction of species not native to the islands, are questions requiring careful investigation.

The expedition sailed from San Francisco for Honolulu May 29, and the summer and early fall were devoted to work along these lines.

Preliminary to a proper understanding of the economic phases of the fisheries, it is of course necessary that we know just what species of fishes and other aquatic animals inhabit or frequent Hawaiian waters. A large part of the time of the present expedition was therefore devoted to making collections of the species brought to the market by the fishermen and such as could be obtained by the use of seines and other means in shallow water along and near the shore. Mr. Cobb devoted his entire time to the methods and statistics of the fisheries.

About 350 species of fishes were obtained, about 70 of them being new to science, in addition to about 100 obtained by Dr. Jenkins in his expedition of 1889 and only lately described by him. A detailed account of the fishes of the islands will be published later, illustrated by colored plates taken from fresh and often from living specimens by Messrs. Hudson and Baldwin.

The fishes of Hawaii are remarkable for their brilliancy of color, a trait which they share with fishes of other volcanic and coral islands of the Tropics. Of the many species which come into the markets nearly all are good food-fishes. A very few (mostly puffers—*Tetraodontidæ*) are poisonous—or at least noxious—and a few species living in the crevices of the reefs are too small to be sought for food purposes.

As the natives mostly eat some fishes raw, certain species not of especial excellence when cooked are very highly valued by them. This is especially true of the parrot-fishes (*Scarus*), which sell in the market at prices which seem extraordinarily high.

FOOD-FISHES.

The following is a list of the principal fishes of the Hawaiian Islands, the majority of which are used as food, arranged according to the alphabetical order of the native names, together with the identifications, so far as they have been determined:

Common name.	Scientific name.
Aalaihi	Thalassoma duperreyi.
Aawa	Lepidoplois bilunulatus.
Aha	Athlennes (new species).
Ahi	Germo sibi.
Aholehole	Kuhlia malo.
Akilolo	Gomphosus and Thalassoma, species.
Aku	Gymnosarda pelamis.
Akule	Trachurops crumenopthalmus.
Aleihi	Holocentrus diadema, etc.
Aloiloi	
Amaama	Mugil dobula.
Anae	Mugil dobula (adult).
Api	Zebrasoma guttatum.
A'ua'a	Chænomugil (new species).
Awa	Chanos chanos.
Awa kalamoho	Chanos chanos.
Awaawa	Elops machnata.
Awela	Thalassoma purpureum.
Aweoweo	Priacanthus cruentatus.
Ea	Lepidoplois modestus.
Hapuupuu	Epinephelus (new species).
Hauliuli	Lemnisoma thyrsitoides.
Hihimanu	Aetobatus narinari.
Hilu	Anampses cuvieri.
Hilulauli	Coris lepomis.
Hinalea	Coris, Novaculichthys, etc.
Hinalea lolo	Coris gaimardi.
Humuhumu meemee	Hemiramphus depauperatus.
Humuhumu	Melichthys bispinosus, etc.
Iheihe	Euleptorhamphus longirostris.
Ii	
Iiao	
Iono	Remora remora.
Kahala	Seriola, species.
Kaku	Sphyræna snodgrassi.
Kala	Monoceros unicornis.
Kawakawa	Gymnosarda alleterata.
Kalekale	
Kawalea	
Kikakapu	Chætodon ornatissimus.
Koae	
Koi	Etelis carbunculus
Kole	

Common name.	Scientific name.
Kuapaa	
Kumu	Upeneus porphyreus.
Kupipi	
Kupoupou	Cheilio inermis.
Laenihi	Iniistius, Hemipteronotus, etc.
Lai	Scomberoides toto.
Laipala	Zebrasoma flavescens.
Lao	Halichæres lao.
Lauhau	Chætodon quadrimaculatus.
Lauia	Scarus jordani, etc.
Lauwiliwili	Forcipiger longirostris.
Lolohau	Cephalacanthus orientalis
Loueu	Zanclus canescens.
Laukipala	Lampris luna.
Mahihi	Coryphæna hippurus.
Mahimahi	Coryphæna hippurus.
Maiii	Teuthis nigroris.
Maikoiko	Teuthis lineolatus.
Makaa	Malacanthus brevirostris.
Malamalama	
Malolo	Cypsilurus simus.
Mamama	Abudefduf abdominalis.
Mamamo	Kyphosus fuscus.
Mamamu	Sphærodon grandoculis.
Maneoneo	Zebrasoma hypselopterum.
Manini	Teuthis sandwichensis.
Mano	Shark.
Mano kihikihi	Sphyrna zygæna.
Maumau	
Mikiawa	
Moa	Ostracion camurum.
Moano	Upeneus velifer.
Moi	Polydactylus sexfilis.
Moi-lii	
Mu	Sphærodon grandoculis.
Munu	Upeneus trifasciatus.
Nainai	Teuthis olivaceus.
Nanihu	
Nehu	Anchovia purpurea. Atherina (new species).
Nenue	Kyphosus fuscus.
Nihipali	
Nohu	Scorpænopsis cacopsis.
Nohupinao	
Nunu	Aulostomus chinensis.
Oau	
Oili	Monocanthus spilosomus.
Oililepa	Alutera scripta.
Oio	Albula vulpes.
Okuhekuhe	
Olale	Thalassoma purpureum.
Omakaha	Perkinsia (new species).
Omilu	Carangus melampygus and C. bajad.
Ono	
Oopu	Eleotris fusca and gobies of all species.
Oopuhue	Tetrodon hispidus (reputed very poisonous).
Oopukai	
Opakapaka	Apsilus kelloggi.
Opelu	Decapterus pinnulatus.
Opule	Anampses evermanni, etc
Paapaa	Cirrhites marmoratus.
Paka	
Pakaikawale	
Pakalakala	
Pakii	Platophrys pantherinus.
Pakiki	
Pakole	Teuthis olivaceus.
Pakuikui	Teuthis achilles.

Common name.	Scientific name.
Pala	
Palani	Teuthis matoides.
Palukaluka	Scarus paluea.
Paoo	Salarias, species.
Paookauila	Salarias, species.
Paopao	
Panuhunuhu	Scarus gilberti.
Papiopio	Carangus (species with yellow fins).
Pauu	Myripristis (new species).
Piha	
Pilikoa	Paracirrhites forsteri, etc.
Poopaa	Paracirrhites cinctus.
Poou	Cheilinus hexagonatus.
Poupou	
Puaa humuhumu	Balistes rectangulus.
Pua-ii	
Pua kahala	Seriola purpurascens.
Pualu	Teuthis dussumieri.
Puhei	Echidna zebra.
Puhi	Gymnothorax (new species.)
Puhikii	Parexoccetus mesogaster.
Puhilaumilo	Gymnothorax undulatus.
Puhiuha	Leptocephalus marginatus.
Puhi wela	Gymnothorax pectus.
Puwalu	
Puuili	
Uhu	Calatomus sandwichensis, etc.
Uhuula	Scarus ahula.
Uiui	Platophrys pantherinus.
Ukikiki	Aprion microdon.
Uku	Aprion virescens.
Ulae	Synodus varius.
Ulaula	Etelis marshi.
Ulaula	Apsilus kelloggi.
Ulua	Carangus sausun and other large species of Carangus.
Ulua kihi	Alectis ciliaris.
Umaumalei	
Uouoa	
Upapalu	Apogon menesemus.
Uu	Myripristis murdgan.
Uwau	
Uwiwi	Monacanthus spilosomus.
Walu	
Weke	Upeneus (all species with yellow stripe on side).
Weke puso	Upenoides vittatus.
Weke ula	Mulloides pflugeri.
Wekepahulu	Upenoides vittatus.
Welea	
Wolu	

LAWS RELATING TO THE FISHERIES.

Previous to about 1830 a state of affairs very much resembling the feudal system of Europe during the middle ages existed on the islands. The King and chiefs owned all the lands, while the common people were mere tenants at will, whose duty it was to support their feudal lord and his numerous retinue in peace by the sweat of their brows, and in war defend him with their lives.

A unique feature of this system was that not only were the lands owned by the chiefs but the exclusive right to fish in the waters of

the ocean adjacent to the estates was in most instances considered a part of the estates themselves, and as a result of this condition of affairs the common people were prevented from gathering from the sea, without vexatious restrictions and grevious exactions, that very necessary part of their food supply which they so much loved and which the sea could furnish in such abundance. The only redeeming feature in this was that if his landlord became too exacting the tenant could move on to the land of some more lenient taskmaster. As the importance of the chief was determined largely by the number of tenants he had on his lands, this proved at times a check on the rapaciousness of some of the chiefs.

In order to continue this condition of affairs more securely in their own hands the ruling classes had recourse to the system of tabu (a corruption of the Hawaiian word "kapu"). To tabu was to command to do or not to do, and the meaning of it was "obey or die." The tabu was a prerogative adhering exclusively to political and ecclesiastical rank, and was common to the Polynesian tribes, having been adopted and enforced by the priesthood and nobility as a protection to their lives, property, and dignity. In nearly every instance the penalty for breaking a tabu was death. Tabus were of two kinds, perpetual and temporary.

The perpetual tabus were universal and were well known to the people. It was perpetual tabu, except to the higher nobility, to cross the shadow of the king, to stand in his presence without permission, or to approach him except upon the knees. Everything pertaining to the priesthood and temples was under perpetual tabu. Squid, turtle, and two or three species of birds could be eaten only by the priests and tabu nobility, while women were tabued from eating plantains, bananas, cocoanuts, the flesh of swine and certain fish, among them the kumu, moano, ulua, honu, ea, hahalua, and naia. Men and women were allowed under no circumstances to partake of food together. This last tabu applied to everybody in the kingdom—king, nobles, and common people—and was one of the most oppressive of the religious tabus, as it necessitated having separate eating-houses for the women and men, thus putting everybody to considerable unnecessary expense and trouble.

The incidental and temporary tabus were the most oppressive and dangerous to the common people, as they were liable to be thoughtlessly violated. The king and tabu nobility would tabu favorite paths, springs, streams, and bathing-places, etc., as the whim seized them.

The general tabus declared by the king were proclaimed by herald, while the temporary tabus were notified to the people by a staff, surmounted by a crown of white or black kapa, stuck in the ground close to the object declared sacred.

The priesthood received its death blow in 1819, when Liholiho, the king, destroyed the idols and broke the worst of the religious tabus by eating openly with his queen. The common people, and, strange

to relate, the priests themselves, followed his example, and in a few weeks the country was without any religion at all.

In the fisheries the king usually had certain fishes tabued, while the chiefs or landlords (called "konohikis") had the same privilege with one species in the sea fisheries belonging to their respective estates. This tabu did not prevent the fishermen from catching the species so set apart, but they were compelled to hand over to the king or chiefs all or a portion of the catch of these species.

The advent of the American missionaries in 1820, coming as it did immediately after the destruction of the native religion by Liholiho, was most fortunate, the people being ripe for a change, and they gladly embraced the Christian religion after a short period of hesitation. The missionaries reduced the native language, which had been oral previously, to writing, and under their direction the people made probably the most remarkable advances in civilization and education ever witnessed among a heathen race. Stimulated by this great advance in intelligence and learning, the king, Kamehameha III, in conjunction with the chiefs and nobles, in 1839, gave the people a written constitution and code of laws. The following are the provisions in this document which relate to the fisheries:

CHAPTER III.—8. *Of free and prohibited fishing grounds.*

1. *Of free fishing grounds.*—His Majesty the King hereby takes the fishing grounds from those who now possess them from Hawaii to Kauai, and gives one portion of them to the common people, another portion to the landlords, and a portion he reserves to himself.

These are the fishing grounds which His Majesty the King takes and gives to the people: The fishing grounds without the coral reef, viz, the Kilohee grounds, the Luhee ground, the Malolo ground, together with the ocean beyond.

But the fishing grounds from the coral reef to the sea beach are for the landlords and for the tenants of their several lands, but not for others. But if that species of fish which the landlord selects as his own personal portion should go on to the grounds which are given to the common people, then that species of fish, and that only, is tabooed; if the squid, then the squid only; or if some other species of fish, that only and not the squid. And thus it shall be in all places all over the islands; if the squid, that only; and if in some other place it be another fish, then that only and not the squid.

If any of the people take the fish which the landlord taboos for himself, this is the penalty: For two years he shall not fish at all on any fishing ground. And the several landlords shall give immediate notice respecting said fisherman that the landlords may protect their fishing grounds, lest he go and take fish on other grounds.

If there be a variety of fish on the ground where the landlord taboos his particular fish, then the tenants of his own land may take them, but not the tenants of other lands, lest they take also the fish tabooed by the landlord. The people shall give to the landlord one-third of the fish thus taken. Furthermore, there shall no duty whatever be laid on the fish taken by the people on grounds given to them, nor shall any canoe be taxed or tabooed.

If a landlord having fishing grounds lay any duty on the fish taken by the people on their own fishing grounds, the penalty shall be as follows: For one full year his own fish shall be tabooed for the tenants of his own particular land, and notice shall be given of the same, so that the landlord who lays a duty on the fish of the people may be known.

If any of the landlords lay a protective taboo on their fish, when the proper fishing season arrives all the people may take fish, and when the fish are collected they shall be divided, one-third to the fishermen and two-thirds to the landlord. If the landlord seize all the fish and leave none for the fishermen, the punishment is the same as that of the landlords who lay a duty on the fish of the people.

If, however, there is any plantation having fishing grounds belonging to it, but no reef, the sea being deep, it shall still be proper for the landlord to lay a taboo on one species of fish for himself, but one species only. If the parrot-fish, then the parrot-fish only; but if some other fish, then that only and not the parrot-fish. These are the enactments respecting the free fishing grounds, and respecting the taking of fish.

2. *Respecting the tabooed fishing grounds.*—Those fishing grounds which are known by the people to have shoals of fish remaining upon them shall, at the proper season for fishing, be placed under the protective taboo of the tax officers for the King. The fishing grounds on Oahu thus protected are: 1, Kalia; 2, Keehi; 3, Kapapa; 4, Malaeakuli; 5, Pahihi. On Molokai as follows: 1, Punalau; 2, Ooia; 3, Kawai; 4, Kohola-nui; 5, Kaonini; 6, Aikoolua; 7, Waiokama; 8, Heleiki. On Lanai, the bonito and the parrot-fish. On Maui, the kuleku of Honuaula and other places. On Hawaii, the albicore.

On Kauai, the mullet of Huleia, Anehola, Kahili, and Hanalei, and the squid and fresh-water fish of Mana, the permanent shoal fish of Niihau, and all the transient shoal fish from Hawaii to Niihau, if in sufficient quantity to fill two or more canoes, but not so small a quantity as to fill one canoe only. But if the fishermen go and borrow a large canoe, that all the fish may be put into one, then there shall be a duty upon them.

On the above conditions there shall be a government duty on all the transient shoal fish of the islands. The tax officer shall lay a protective taboo on those fish for his Majesty the King, and when the proper time for taking the fish arrives, then the fish shall be divided in the same manner as those which are under the protective taboo of the landlords.

If the tax officer seize all the fish of the fisherman, and leave none for those who take them, then he shall pay a fine of ten dollars, and shall have nothing more to say respecting the royal takes. But if the order for seizing all the fish of the fishermen was from the governor, then he shall no longer be governor, though he may hold his own lands, and the tax officer shall not be turned out of office. At the proper time the tax officer may lay a protective taboo on all the King's fish and the landlords all around the island. But it is not proper that the officer should lay the taboo for a long time. The best course is for the officer to give previous notice to the fishermen, and then the common people and the landlords, to fish on the same day. Thus the rights of all will be protected.

But no restrictions whatever shall by any means be laid on the sea without the reef, even to the deepest ocean, though those particular fish which the general tax officer prohibits, and those of the landlords which swim into those seas, are taboo. The fine of those who take prohibited fish is specified above.

KAMEHAMEHA.
KEKAULUOHI.

Enacted June 7, 1839.

On April 1, 1841, the nobles met at Luaehu, in Lahaina, and made the following changes in the above laws:

5. *Of shoal fish.*—From the eighth section of the third chapter of this law, which is found on thirty-eighth page, certain words shall be erased, as follows: "If in sufficient quantities to fill two or more canoes, but not so small a quantity as to fill one canoe only."

The transient shoal fish spoken of in this law are: (1) The Akule, (2) the Anaeholo, (3) the Alalauwa, (4) the Uhukai, (5) the Kawelea, (6) the Kawakawa, (7) the

Kalaku. These kinds of fish shall be divided equally whenever they arrive at these islands, or whenever they drift along.

6. *Of duties laid by land agents on the fish of the people.*—On the twenty-seventh page, chapter 3, section 8, read thus: "The people of other lands shall give to the landlord one-third of the fish thus taken on said land."

9. *Of the punishment of fishermen.*—In the third chapter, eighth section, page 37, the following words are erased: "For two years he shall not fish at all on any fishing ground." The following words shall also be inserted in their place: "If he take one fish criminally, he shall pay five, and always at that rate. And if a canoe full be taken five canoes full shall be paid, according to the amount taken, even to the furthest extent."

11. *Of the tax for the year 1841.*—5. Where none of these kinds of property can be obtained, and fish are abundant, then the tax shall be laid in fish, and shall be in proportion to what the tax of the land would be in money. If the land would be taxed a fathom swine, then there shall be an amount of fish equal in value to ten dollars.

21. *Of the protection of the fisheries.*—The following words are to be inserted in the eighth section of the third chapter, on the thirty-eighth page: "The general tax officer may lay a protective taboo on the King's fish, and also on those of the land agents, but the land agents and the King also may eat of their own fish tabooed by themselves, even before the taboo of the tax officer is repealed."

In 1845 it was found necessary to define more clearly the rights of the respective parties, and the following was adopted in connection with other legislation:

CHAPTER VI.—ARTICLE V.—*Of the public and private rights of piscary.*

SECTION I. The entire marine space without and seaward of the reefs upon the coasts of the several islands comprising the several fishing grounds commonly known as the Kilohee grounds, Luhee grounds, the Malolo grounds, and the fishery of the ocean from said reefs to the limit of the marine jurisdiction in the first article of this chapter defined shall be free to the people of these islands. The people shall not be molested in the enjoyment thereof except as hereinafter provided.

SEC. II. The fishing grounds from the reefs, and where there happen to be no reefs from the distance of one geographical mile seaward to the beach at low-water mark, shall in like manner be considered private property of the landlords whose lands by ancient regulation belong to the same; in the possession of which private fisheries the said landlords shall not be molested except to the extent of the reservations and prohibitions hereinafter set forth.

SEC. III. The landlords shall be considered in like manner to hold said private fisheries for the equal use of themselves and of the tenants on their respective lands; and the tenants shall be at liberty to use the fisheries of their landlords, subject to the restrictions in this article imposed.

SEC. IV. The landlords shall have power each year to set apart for themselves one given species or variety of fish natural to their respective fisheries, and give public notice by viva voce proclamation to their tenants and others residing on their lands, and signifying to the minister of the interior, in writing, through his agents in their districts, the kind and description of fish which they have chosen to set apart for themselves. The landlords shall respectively pay for such notification the fees prescribed by the third part of this act; and it shall be the duty of the minister of the interior yearly to furnish the director of the government press with the list of said landlords, the districts and islands of their residence, and the kind of fish specially set apart by each, in the form of catalogue, which catalogue the said director shall cause to be once inserted, in Hawaiian and English languages, in the Polynesian

newspaper, for public information, at the expense of said minister, to be included by him according to a fixed rate in the fees to be received at his department from the respective landlords.

SEC. V. The specific fish so set apart shall be exclusively for the use of the landlord if caught within the bounds of his fishery, and neither his tenants nor others shall be at liberty to appropriate such reserved fish to their private use; but when caught such reserved fish shall be the property of the landlord, for which he shall be at liberty to use and recover the value from any fisherman appropriating the same; and, moreover, if he take one fish criminally he shall pay five, and in that proportion shall pay the full amount of what he may have taken wrongfully. Whoever may have taken fish in violation of this law, without paying as above, shall be fined fifty dollars for each offense.

SEC. VI. The landlords shall not have power to lay any taxes or to impose any other restrictions upon their tenants regarding the private fisheries than is in the preceding section prescribed, neither shall such further restrictions be valid.

SEC. VII. It shall be competent to the landlords, on consultation with the tenants of their lands, in lieu of setting apart some peculiar fish to their exclusive use as hereinbefore allowed, to prohibit during certain indicated months of the year all fishing of every description upon their fisheries; and during the fishing season to exact of each fisherman among their tenants one-third part of all the fish taken upon their private fishing grounds. In every such case it shall be incumbent on the landlords to comply in like manner with the requirements of the fourth section of this article.

SEC. VIII. The royal fish shall appertain to the Hawaiian Government and shall be the following,* viz:

First. The bonito when off any part of the coast of Lanai.

Second. The albicore of Hawaii.

Third. The mullet of Huleia, Anehola, and Hanalei; the squid and freshwater fish of Kauai.

Fourth. The shoal fish taken at the following places noted for the abundance of fish frequenting them: Off Oahu: 1, Kalia; 2, Keehi; 3, Kapapa; 4, Malaeakuli, and 5, Pahihi.

Fifth. Off Molokai: 1, Punalau; 2, Ooia; 3, Kawai; 4, Koholanui; 5, Kaonini; 6, Aikoolua; 7, Waiokama, and 8, Heleiki.

Sixth. And off Maui; the kuleku of Honuaula; and the same whenever found off said island.

Seventh. All the following transient fish, viz: 1, the kule; 2, the anaeholo; 3, the alalauwa; 4, the uhukai; 5, the kawelea; 6, the kawakawa; 7, the kalaku.

These shall be divided equally between the King and fishermen. But on all the prohibited fishing grounds the landlords shall be entitled to one species of fish and those who have walled fish ponds shall be allowed to scoop up small fish to replenish their ponds. If the prohibited fish of the landlord be mingled with the royal fish, then the landlord shall be entitled to one-third of the whole of the fish taken, though this applies only to Molokai, Oahu, and the reefs of Kauai.

All which shall be yearly protected by the king's taboo, to be imposed by the minister of the interior by means of circular from his department, as prescribed in the act to organize the executive ministry; and during the specified season of taboo they shall not be subject to be taken by the people.

SEC. IX. At the expiration of the taboo seasons all persons inhabiting these islands shall be at liberty to take the protected fish, accounting to the fishery agents of the

* A number of the common names in use at that time have since been changed so that at present it is a difficult matter to determine the scientific names of the species mentioned in the law. The following are some which have been determined: The bonito, *Gymnosarda pelamis;* the albicore, *Germo sibi;* the mullet, *Mugil dobula;* kule, *Trachurops crumenophthalmus;* the anaeholo, a young mullet; the alalauwa, *Priacanthus;* the kawakawa, *Gymnosarda alleterata.*

respective districts off which the same shall have been caught for the half or portion so taken; and the minister of the interior shall make known through his agents by viva voce proclamation the respective months or seasons of the year during which the said royal fisheries may be used and the said protected fish taken.

SEC. X. The minister of the interior shall appoint suitable and proper fishing agents in the several coast districts of the respective islands to superintend the fisheries aforesaid, to whom he shall from time to time give directions through the respective governors in regard to the sale or other disposition of the share of fish accruing to the government.

SEC. XI. It shall be the duty of the agents appointed to exact and receive of all fishermen for the use of the royal exchequer during the legalized fishing seasons the one-half part or portion of all protected fish taken without the reefs, whether at the respective places in the eighth section of this article indicated, or in the channels and inclosed seas dividing these islands, or upon the high seas within the marine jurisdiction of this country. And if any officer or agent of this government shall exact more fish of the people than is in and by this section expressly allowed he shall on conviction forfeit his office and be liable to pecuniary fine, in the discretion of the court before which he shall have been convicted.

SEC. XII. It shall be competent for His Majesty by an order in council from time to time to set apart any given portion or any definite kind of the said protected fish, or any proportional part of the avails therefrom arising for the use of the royal palace, to be delivered or paid over to the chamberlain of his household created by the third part of this act.

SEC. XIII. It shall be incumbent on the minister of the interior to provide, by instructions to the respective governors, for the sale and disposal of all fish received by the said fishing agents, and to pay the avails thereof to the minister of finance.

SEC. XIV. If any person shall, in violation of this article, take out of season the fish protected by the king's taboo, or if any person shall, within the free fishing seasons, take any of the protected fish without delivering to the agent appointed for that purpose the proportion accruing to the royal exchequer, he shall, on conviction, forfeit all fish found in his possession, and shall, in addition, pay fivefold for all fish thus taken, or he may be put in confinement, at the discretion of the court condemning him.

In 1850, under the heading of "Malicious injuries and mischiefs," the "destroying, cutting, injuring or impairing the usefulness or value of any fish net," etc., and the "putting of auhuhu or other substance deleterious to fish into any lake, pond, stream, or reservoir for the purpose of destroying the fish," were made misdemeanors.

As it was found to be a difficult matter to collect the government's share, and the fishing agents were oppressing the people, it was decided in the following act to give to the people the free use of the government fisheries.

AN ACT granting to the people the rights of piscary now belonging to the government.

Whereas the fish belonging to the government are productive of little revenue; and whereas the piscary rights of the government as managed by the fishing agents are a source of trouble and oppression to the people: Therefore,

Be it enacted by the house of nobles and representatives of the Hawaiian Islands in legislative council assembled: SECTION 1. That thirty days from and after the publication of this act in the Elele and Polynesian newspapers all fish belonging to or especially set apart for the government shall belong to and be the common property of all the people equally; excepting that the two-thirds mentioned in section 8, number 7, article 5, chapter 6, part 1, of the "Act to organize the executive departments," shall

not be exacted of the konohiki; and in all cases where the konohiki shall set apart one kind of fish only, as per section 4 of said law, such fish shall belong to the konohiki exclusively and without deviation or molestation.

SEC. 2. All fishing grounds pertaining to any government land, or otherwise belonging to the government, excepting only ponds, shall be, and are hereby, forever granted to the people for the free and equal use of all persons: *Provided, however*, That for the protection of such fishing grounds the minister of the interior may taboo the taking of fish thereon at certain seasons of the year.

SEC. 3. The minister of the interior shall give public notice in the Elele and Polynesian newspapers of any such taboo imposed by him, together with the name of such fish, and no such taboo shall be in force until due notice has been given. Any person who shall be found guilty of violating such taboo, upon complaint before any district justice, shall be punished by a fine not exceeding fifteen dollars in the discretion of the court, and restore all fishes taken, or the value thereof.

SEC. 4. No person living without the Kingdom shall take any fish within the harbors, streams, reefs, or other waters of the same for the purpose of carrying them for sale or otherwise to any place without the Kingdom.

SEC. 5. Every person violating the provisions of the preceding section may be punished, upon complaint made to any district justice, by a fine not exceeding two hundred dollars in the discretion of the court.

SEC. 6. All acts or parts of acts, resolves or parts of resolves, contrary to the provisions of this act shall be, and the same are hereby, repealed.

SEC. 7. The minister of the interior is hereby charged with the execution of this act.

Approved by the King July 11, 1851.

Although the government had given the people free access to the fisheries attached to its lands, many persons who had purchased or leased land from the government after this had been done attempted to assert exclusive rights to the fisheries adjacent to the lands, and refused the fishermen the rights they had previously enjoyed. In order to redress this grievance the following law was enacted in 1851:

AN ACT to protect the people in certain fishing grounds.

Whereas certain persons to whom government lands have been sold have assumed exclusive rights of fishing in the sea adjacent to said land, without the justification of law; and whereas the people in numerous instances have been unjustly deprived of their rights to the fish on the grounds long since made free to them by law, namely, on the fishing grounds commonly known as the Kilohee grounds, the Luhee grounds, the Malolo grounds, and the fishing of the ocean from the reefs seaward; and whereas the present law affords no sufficient protection to the people in those rights: Therefore,

Be it enacted by the nobles and representatives of the Hawaiian Islands in Legislative Council assembled:

SECTION 1. That no person who has bought or who may hereafter buy any government land, or obtain land by lease or other title from any party, has or shall have any greater right than any other person resident in this Kingdom over any fishing ground not included in his title, although adjacent to said land. The fish in said fishing ground shall belong to all persons alike, and may be taken at any time, subject only to the taboos of the minister of the interior.

SEC. 2. If that species of fish which has been tabooed by any konohiki shall go onto the grounds which have been or may be given to the people, such fish shall not be tabooed them. It shall only be tabooed when caught within the bounds of the

konohiki's private fishery. Nor shall it be lawful for a konohiki to taboo more than one kind of fish upon any fishing grounds which lie adjacent to each other.

SEC. 3. Every konohiki or other person who shall wilfully deprive another of his legal rights to fish on any fishing ground which now is or may become free to the use of the people, or who shall wilfully exact from another any portion of the fish caught on any public fishing ground, or who shall wilfully exact of another for the use of any private fishery a greater amount of fish than by law he is entitled to receive as his share, and any tenant or other person who shall wilfully deprive any konohiki of his fishing rights by appropriating to himself the tabooed fish of said konohiki, or otherwise, shall be punished by a fine not exceeding one hundred dollars for every such offense, in the discretion of the court, and in default of the payment of said fine be imprisoned at hard labor until the same is paid.

SEC. 4. The several district justices of the Kingdom shall have power to try and punish all offenders against the provisions of the preceding section committed in their respective districts.

SEC. 5. This act shall take effect ten days from and after the publication of the same in the Elele and Polynesian newspapers.

In 1859 a civil code, embracing all the laws then in force, was prepared for and passed by the legislature. The sections relating to the fisheries were as follows:

CHAPTER VII.—ARTICLE V.—*Of the fisheries.*

SEC. 384. All fishing grounds appertaining to any government land, or otherwise belonging to the government, excepting only ponds, shall be, and are hereby, forever granted to the people, for the free and equal use of all persons: *Provided, however*, That for the protection of such fishing grounds the minister of the interior may taboo the taking of fish thereon at certain seasons of the year.

SEC. 385. The minister of the interior shall give public notice of any such taboo imposed by him, and no such taboo shall be in force until such notice has been given. Every person who shall violate such taboo shall be punished by a fine not exceeding fifteen dollars and the value of the fish taken.

SEC. 386. No person residing without the kingdom shall take any fish within the harbors, streams, reefs, or other waters of the same for the purpose of carrying them for sale, or otherwise, to any place without the kingdom, under penalty of a fine not exceeding two hundred dollars, in the discretion of the court.

SEC. 387. The fishing grounds from the reefs, and where there happen to be no reefs, from the distance of one geographical mile seaward to the beach at low-water mark, shall, in law, be considered the private property of the konohikis, whose lands, by ancient regulation, belong to the same; in the possession of which private fisheries the said konohikis shall not be molested, except to the extent of the reservations and prohibitions hereinafter set forth.

SEC. 388. The konohikis shall be considered in law to hold said private fisheries for the equal use of themselves and the tenants on their respective lands, and the tenants shall be at liberty to use the fisheries of their konohikis, subject to the restrictions imposed by law.

SEC. 389. The konohikis shall have power each year to set apart for themselves one given species or variety of fish natural to their respective fisheries, giving public notice by viva voce proclamation, and by at least three written or printed notices posted in conspicuous places on the land, to their tenants and others residing on their lands, signifying the kind and description of fish which they have chosen to be set apart for themselves.

SEC. 390. The specific fish so set apart shall be exclusively for the use of the konohiki if caught within the bounds of his fishery, and neither his tenants nor others shall

be at liberty to appropriate such reserved fish to their private use; but when caught such reserved fish shall be the property of the konohiki, for which he shall be at liberty to sue and recover the value from any person appropriating the same.

SEC. 391. The konohikis shall not have power to lay any tax or to impose any other restriction upon their tenants, regarding the private fisheries, than is hereinbefore prescribed, nor shall any such further restriction be valid.

SEC. 392. It shall be competent to the konohikis, on consultation with the tenants of their lands, in lieu of setting apart some particular fish to their exclusive use, as hereinbefore allowed, to prohibit during certain months in the year all fishing upon their fisheries, and during the fishing season to exact of each fisherman among the tenants one-third part of all the fish taken upon their private fishing grounds. In every such case it shall be incumbent on the konohikis to give the notice prescribed in section 389.

SEC. 393. No person who has bought, or who may hereafter buy, any government land, or obtain lease or other title from any party, has or shall have any greater right than any other person resident in this kingdom over any fishing ground not included in his title, although adjacent to said land.

SEC. 394. If that species of fish which has been abooed by any konohiki shall go on to the grounds which have been or may be given to the people, such fish shall not be tabooed thereon. It shall be tabooed only when caught within the bounds of the konohiki's private fishery. Nor shall it be lawful for a konohiki to taboo more than one kind of fish upon any fishing grounds which lie adjacent to each other.

SEC. 395. Every konohiki or other person who shall willfully deprive another of any of his legal rights to fish on any fishing ground which now is, or may become, free to the use of the people, or who shall willfully exact from another any portion of the fish caught on any public fishing ground, or who shall wilfully exact of another, for the use of any private fishery, a greater amount of fish than by law he is entitled to receive as his share, and any tenant or other person who shall willfully deprive any konohiki of his fishing rights, by appropriating to himself the tabooed fish of said konohiki, or otherwise, shall be punished by a fine not exceeding one hundred dollars for every such offense, in the discretion of the court, and in default of the payment of such fine be imprisoned at hard labor not exceeding three months.

SEC. 396. The several district justices shall have power to try and punish all offenses against the provisions of the last preceding section committed in their respective districts.

For some years the use of giant powder or dynamite in the fisheries was permitted. Owing to ignorance or carelessness in handling this dangerous explosive such a large number of persons had lost their lives or been maimed that in 1872 the following law forbidding its use was passed:

AN ACT to prevent the use of explosive substances in taking Fish.

Be it enacted by the King and the legislative assembly of the Hawaiian Islands in the legislature of the Kingdom assembled: SECTION 1. No person shall use giant powder or any other explosive substance in taking fish within or upon any harbors, streams, reefs, or waters within the jurisdiction of this Kingdom.

SEC. 2. Whoever violates the provisions of the preceding section shall be punished by a fine not exceeding five hundred dollars and not less than twenty-five dollars, or by imprisonment at hard labor not exceeding five years and not less than three months, or both at the discretion of the court.

SEC. 3. The several district justices and police courts shall have concurrent jurisdiction in all cases under this act.

In 1888 this law was amended as follows:

SECTION 1. That section 1 of an act entitled "An act to prevent the use of explosive substances in taking fish," approved June 3, A. D. 1872, be, and the same is hereby, amended by adding to said section the following words:

"The possession by fishermen, fish venders, or persons in the habit of fishing, of fish killed by giant powder or other explosive substance shall be prima facie evidence that the person in whose possession such fish were found used giant powder or some other explosive substance in taking such fish, contrary to the provisions of this act."

SEC. 2. That section 2 of said act be, and the same is hereby, amended so as to read as follows:

"Whoever violates the provisions of this act shall be punished by a fine not exceeding two hundred dollars and not less than fifty dollars, or by imprisonment at hard labor not exceeding one year, or both, in the discretion of the court."

The general act was again amended in 1892, so as to make the penalty a fine not exceeding $100 nor less than $25, or by imprisonment at hard labor not exceeding six months, or both, in the discretion of the court. Unfortunately this law is not very closely enforced, and as a result great destruction is still being wrought to the fisheries by the use of this explosive, especially in the more inaccessible portions of the islands.

For many years it had been a common practice for the fishermen to catch young fish, particularly the mullet and awa, and sell them. This had proved such a heavy drain upon the supply of these species that in 1888 the following law was adopted:

AN ACT to provide for the protection of certain fish within the bays, harbors, waters, or streams of the Hawaiian Islands.

Be it enacted by the King and the Legislature of the Hawaiian Kingdom:

SECTION 1. It shall not be lawful for any person to take, catch, or destroy the young of the fish known as the mullet and the awa under 4 inches in length in any of the bays, harbors, waters, or streams of this Kingdom: *Provided, however,* That nothing in this act shall prevent the taking of the fish herein above prohibited for the purpose of stocking ponds.

SEC. 2. It shall not be lawful for any person to sell or offer for sale, or have in his possession, except alive, any of the young fish mentioned in section 1 of this act.

SEC. 3. Any person violating the provisions of this act shall, upon conviction before any police or district magistrate, be punished by a fine of not less than twenty dollars nor more than two hundred dollars, or by imprisonment at hard labor for not less than ten nor more than ninety days, or by both such fine and imprisonment, in the discretion of the court: *Provided, nevertheless,* That no such fine shall be imposed upon any person who, fishing for other fish, accidentally takes or catches no more than forty of the young fish mentioned in section 1 of this act.

SEC. 4. This act shall take effect from and after the date of its approval.

Approved this sixth day of September, A. D. 1888.

In 1892 the following amendment to a previous law, designed to clear up disputed points which had arisen, was passed:

Be it enacted by the Queen and Legislature of the Hawaiian Kingdom:

SECTION 1. Section 388 of the civil code shall be, and the same is hereby, amended to read as follows:

"SEC. 388. The konohikis shall be considered in law to hold said private fisheries for the equal use of themselves and of the tenants on their respective lands; and the

tenants shall be at liberty to take from such fisheries, either for their own use or for sale or exportation, but subject to the restrictions imposed by law, all fish, seaweed, shellfish, and other edible products of said fisheries."

SEC. 2. This act shall take effect and become a law from the date of its approval.

Approved this 4th day of August, A. D. 1892.

The various changes and modifications made in the fishery laws from time to time have been in the direction of their simplification and explanation, that the rights of fishermen and the konohiki might be more clearly defined. It also appears that the rights and privileges of the common people were extended from time to time. Since annexation the only legislation pertaining to the fisheries of the islands by the Congress of the United States is in three sections of the enabling act, section 94, providing for the investigations upon which this paper is based, and already quoted, and sections 95 and 96, as follows:

REPEAL OF LAWS CONFERRING EXCLUSIVE FISHING RIGHTS.

SEC. 95. That all laws of the Republic of Hawaii which confer exclusive fishing rights upon any person or persons are hereby repealed, and all fisheries in the sea waters of the Territory of Hawaii not included in any fish pond or artificial inclosure shall be free to all citizens of the United States, subject, however, to vested rights; but no such vested right shall be valid after three years from the taking effect of this act unless established as hereinafter provided.

PROCEEDINGS FOR OPENING FISHERIES TO CITIZENS.

SEC. 96. That any person who claims a private right to any such fishery shall, within two years after the taking effect of this act, file his petition in a circuit court of the Territory of Hawaii, setting forth his claim to such fishing right, service of which petition shall be made upon the attorney-general, who shall conduct the case for the Territory, and such case shall be conducted as an ordinary action at law.

That if such fishing right be established, the attorney-general of the Territory of Hawaii may proceed, in such manner as may be provided by law for the condemnation of property for public use, to condemn such private right of fishing to the use of the citizens of the United States upon making just compensation, which compensation, when lawfully ascertained, shall be paid out of any money in the treasury of the Territory of Hawaii not otherwise appropriated.

Except in a few isolated instances these exclusive fishery rights are of not much importance on any of the islands except Oahu. On this island, especially in the vicinity of Honolulu, they are of considerable value, owing to the easily accessible market afforded by the city. On the other islands the population is too scattered to make the fisheries valuable. The owners of fishery rights usually lease them to Japanese, Chinese, and Hawaiians.

The abolishment of these fishery rights will, in some instances, work very serious damage to the commercial fisheries if proper laws are not provided to take the place of the old restrictions. Under the laws governing these fisheries at present, the owner can, and in some places does, protect certain species, particularly the mullet, during the spawning season by placing a tabu on them, and as everybody had to account to him when fishing he could easily prevent the use of destructive forms of apparatus or overfishing.

The fisheries of Honolulu are rapidly falling off in amount, with a corresponding rise in the prices for fish, which are now perhaps higher than in any other seaport town in the world. One cause of the falling off is to be found in overfishing within a limited area. The markets of Honolulu are supplied by resident fishermen, by fishermen along the line of the Oahu Railway at Waialua and Waianae, and by fishermen on the north side of the Pali, about the village of Heeia. None of these fishermen goes into deep water, or to any great distance from Honolulu. Their equipment is on a relatively small scale, and thus far larger equipments have not been found profitable. The high price of labor, its relative untrustworthy character, and the ease of overstocking the market have brought attempts at fishing on a large scale to a comparative failure. Native fishermen work when they feel like it. Chinese fishermen are afraid of new situations and beset by superstitious fears. Japanese fishermen enter into combinations with their competing fellows, thus defeating the purpose of large fishing plants to control the markets themselves.

The most valuable element in the Hawaiian fisheries is the amaama or mullet (*Mugil dobula*). The system of fencing off arms of the sea for the formation of mullet ponds is practically, in American territory, confined to Hawaii. The recognition of private ownership in such ponds is contrary to American precedents. If it be found impracticable to recognize such private ownership, these ponds may be condemned by the United States Government and again leased to private persons. The best interests of the fisheries will be served by leaving their present owners in undisturbed possession. The matter should, however, receive careful consideration, as the action of Congress will constitute a permanent precedent. Under Hawaiian law the sea between the land and the barrier reef is also held as personal property. The act establishing the Territory of Hawaii wisely provided for the extinction of such titles.

After the fishery rights are abolished in 1903 there will be almost no restrictions on the general fisheries. At the present time very fine-meshed seines are used, especially around Honolulu (Oahu) and Hilo (Hawaii), and immense numbers of very small young fish, such as the mullet (*Mugil dobula*), ulua (*Caranx* sp.), and akule (*Trachurops crumenophthalmus*), from 2 inches in length up, are caught and sold, although it is against the law to sell young mullet under 4 inches in length. Unless this great drain on the young is stopped the fisheries are bound to suffer severely.

The use of fine-meshed nets and the sale of small fish should be absolutely prohibited.

The same remark applies to the various species of *Mullidæ*, known as weke, moano, munu, kumu, umu, etc. Two of these species, the munu (*Upeneus trifasciatus*) and the umu (*Upeneus porphyreus*),

stand among the very first in quality of Hawaiian food-fishes, ranking with the famed red sur-mullet (*Mullus barbatus*) of Europe.

The large shore fishes known as ulua are worthy of similar protection. Hundreds of young too small to be of any food value are taken every day in the seines in Pearl Harbor and in the Bay of Hilo.

For the adequate protection of the fishes of the Hawaiian Islands the following regulations are suggested.

1. The size of the meshes of seines should be limited. No seine with a mesh less than 3 inches in extension should be used. An exception may be made which will allow the use of seines not exceeding 30 feet in length and with mesh not under three-eighths of an inch in extension for the purpose of taking bait.

2. The capture or taking in any manner whatsoever or the selling, offering for sale, or having in possession any amaama, weke, moano, kumu, or nunu, or other fish of the family *Mullidæ* of less than 8 inches in length should be prohibited.

3. The minimum size limit for the ulua and related species of the family *Carangidæ* should be 12 inches.

4. The minimum size limit for all species other than those specifically mentioned above should be 5 inches.

5. The amaama, or mullet, is of great importance on the islands of Oahu and Molokai, and in order to properly conserve the supply the catching of them during their spawning season should be prohibited. Their principal spawning season is from the latter part of October to the early part of February.

6. The selling of female ula (locally known as lobster) when carrying eggs should be strictly prohibited. While there is no present sign of a decrease in the supply of this crustacean, it is better to start now than when it is too late.

7. As the waters of Pearl Harbor (Oahu) seem to be favorably adapted to the raising of oysters it would be well if this industry could be established and fostered by the passage of a law permitting the leasing of small plots of land under water, adjacent to the shores, for the purpose of planting and raising oysters. There are at present a few beds of small native oysters scattered through Pearl Harbor, but very little dependence can be placed upon these to supply the demand. Several efforts have been made to introduce oysters from the eastern portion of the United States and from California, and the results were sufficient to show that with proper care and encouragement, such as recommended above, a profitable industry could be built up.

8. An efficient force of fish wardens should also be provided for in order to see that the laws are properly enforced. Each warden could have a certain district, in which he would reside, and he would thus be enabled to keep a close supervision over the fishermen.

9. It is also recommended that the native birds of the islands should be protected and that a clause to that effect be made a part of any legislation that may be had.

That legislation equivalent to the above recommendations is demanded by the interests of Hawaii admits of no question. It, however, raises the more important question: Should such a statute be passed by Congress and enforced by the Federal judges, marshals, and other officials; or should it be left to the action of the Territorial

legislature? The present commission desires to express no opinion on this large question of national policy. It is proper, however, to state this fact: With the present Territorial legislature it is apparently wholly impossible to pass any kind of statute for the protection of the fisheries. With the present laws governing suffrage there is no prospect of any change in this regard.

The chief argument used against protective laws is the desire of the Hawaiian people to eat little fishes raw. Of these little fishes thus eaten, one or two, called "nehu," never grow large. On the other hand, it may be urged that the nehu is an important food of larger fishes; that the market value of all which are taken is insignificant, and that the young of the mullet and other fishes of real value are taken and eaten with the nehu.

INTRODUCTION OF ADDITIONAL SPECIES OF FISHES, ETC.

The fresh waters of the Hawaiian Islands are too limited in importance to justify experiments in acclimatization. The chief streams are on the island of Kauai. The only native fishes in any of the streams are different species of gobies, known collectively as "oopu." These have some value as food, but are not highly esteemed.

Although the waters adjacent to the islands teem with fishes and other denizens of the sea, numerous efforts have been made to introduce additional species. Among the principal species so far introduced are the following:

From China and Japan.—Gold-fish (*Carassius auratus*), china-fish (*Ophiocephalus*), a species of cat-fish (*Macropternotus maqur*), and one or more species of frogs.

From the United States.—Brook trout (*Salvelinus fontinalis*), black bass (probably *Micropterus salmoides*), cat-fish (*Ameiurus nebulosus*), carp (*Cyprinus carpio*), the bullfrog (*Rana catesbiana*), and terrapin. In 1876 some salmon and trout eggs were sent to parties in Honolulu in exchange for 100 awa; there is no record of what became of these eggs.

The gold-fish and frogs have thrived very well and are now to be found on most of the islands. At Hilo the frogs are so abundant that they have become an article of sale. On the island of Kauai they have been found especially useful in destroying the fluke, *Fasciola hepatica*, which works considerable damage to the cattle. They have also assisted very materially in thinning out some of the noxious insects which have been introduced.

The china-fish is to be found in numbers in the vicinity of Honolulu alone, and is raised in the irrigation ditches and fresh-water ponds. The china-fish and gold-fish are generally sold alive to the Chinese.

The rivers of the islands are, in nearly every instance, small mountain streams, which become torrents in the wet season and a series of pools, connected by slender rivulets, during the dry season. Trout do not thrive under such conditions, and it is a waste of time to attempt

to acclimatize them. Only one plant (on Kauai in 1894) has so far been made, and nothing has been seen or heard of them since.

The small-mouthed black bass, however, would probably thrive under such conditions. One plant of black bass has been made (at Hilo), and though they were never seen again this was probably due to their poor physical condition when planted. Owing to the absence of the consignee when they arrived, they were allowed to remain in the cans for some time before being planted, and as a freshet occurred the next day it is probable they were all carried out to sea. As the rivers are filled with fresh-water shrimp, the bass would have an abundant food supply.

The cat-fish (American and Chinese) are found in considerable numbers on Oahu, in the vicinity of Honolulu. Carp are found on the islands of Maui and Kauai, but are not yet common.

A more valuable fish than the black bass is probably available for these islands. It is the Japanese dwarf salmon or ayu, *Plecoglossus altivelis*. It is one of the most delicate of fishes, breeds freely, and lives in every clear stream of Japan from Hokkaido to Formosa, being thus well adapted to the climate of Hawaii. Perhaps more than any other foreign fish whatever it merits introduction into the waters of the United States, especially into those of California.

Several lots of oysters from the eastern part of the United States and from California have been brought to the islands at different times since 1893 and planted in Pearl Harbor. While the results achieved were not very satisfactory from a financial standpoint, still they were sufficient to show that the business might be put upon a remunerative basis if it were given the time and attention necessary. The eastern oyster was found to breed to a limited extent.

Clams could be planted in Pearl Harbor and in other favorable localities, and would probably thrive well.

The abalone, which is very highly prized by the Chinese, might be introduced on the rocky reefs and sea walls.

The depletion of the fisheries of these islands can be best prevented by proper protective legislation such as we have suggested. Fish-cultural methods have not yet been developed with regard to any of the fishes native to or suitable for these islands. The establishment of a fish-cultural station there is at present wholly impracticable and unnecessary. The establishment, however, of a biological station similar to that at Woods Hole or that at Beaufort, N. C., for the study of the many important problems connected with tropical insular aquatic life is of the highest importance and is earnestly recommended.

FISH PONDS.

The most interesting of the fishery resources of the islands are the fish ponds. Many of these were built so long ago that even tradition

does not approximate the date. As they were originally owned by the kings and chiefs, it is very probable that they were built by the forced labor of the common people. They are found principally in the bays indenting the shores of the islands, the common method of construction being to build a wall of lava rock across the narrowest part of the entrance to a small bay or bight of land and use the inclosed space for the pond. They were also built on the seashore itself, the wall in that case being run out from two points on the shore some distance apart in the shape of a half circle. A few were built somewhat interior, and these are filled by the fresh-water streams from the mountains or by tidal water from the sea carried to them by means of ditches. In the sea ponds the walls are built somewhat loosely, which permits the water to percolate freely. The ponds are arranged with narrow entrances, protected by sluice gates, which can be opened or closed at will. These are frequently left open when the tide is running in, which allows the amaama, or mullet, and the awa to enter freely. When the tide turns the gates are closed, making prisoners those which have entered. The salt-water ponds usually contain only the amaama and awa.

In the fresh and brackish water ponds gold-fish, china-fish, oopu, opai, carp, aholehole, and okuhekuhe are kept. No attempt at fish-culture is made with these ponds, the young fish being captured in the open in the case of most of the species enumerated and placed in the ponds until they attain a marketable size. Large quantities of amaama and awa are handled in these ponds annually, especially on the island of Oahu. Dip nets, seines, gill nets, and scoop nets are used in taking the fish from the ponds; and as they are quite shallow, this is done very easily. The ponds are operated almost exclusively by Chinese.

A number of the ponds have been allowed to fall into decay, particularly on Molokai and Hawaii, while on Oahu others have been filled up to meet the growing demand for rice land and for other purposes. The maintenance of these ponds should be encouraged as much as possible, as they are of great assistance in maintaining a regular supply of fish at all seasons of the year.

The irrigation ditches used in watering the numerous rice fields are also employed incidentally in raising a few of the species enumerated above.

FISH MARKETS AND METHODS OF HANDLING FISHERY PRODUCTS.

There are 7 fish-market houses, 1 each at Honolulu (Oahu), Hilo (Hawaii), and Wailuku (Maui), and 4 at Lahaina (Maui). Peddlers with small carts also retail fish throughout the sections of inhabited country which are not convenient to the markets or to the fisheries. There is great room for development in this part of the business, however, as the inhabitants of some of the more inaccessible villages

rarely ever have an opportunity from one year's end to another to purchase fish.

At Honolulu the market house, with land, is valued at $155,000. It is owned by the Territorial government, and is one of the best appointed fish markets in the United States. A fish inspector, with one assistant, is in charge of the market, and all fish must be inspected by him before they go upon the stalls. In this manner complete control over the fish sold in the city is obtained, as no peddling through the streets is permitted.

There are 20 stalls for the sale of fresh fishery products, the rents of which vary from $15 to $30 per month, according to location. Only 15 of these were occupied in 1900. Of these, 11 were run by Chinese, 3 by Japanese, and 1 by natives, the total number of persons employed being Chinese 40, Japanese 6, and natives 2. In addition to these, 6 tables were occupied by 6 native women on Saturday for the sale of limu (algæ), while 3 tables were devoted to the sale of dried fish during most of the week, and were run by 3 native women. On a few days in the week, when fresh fish are scarce, certain of the dealers also sell pickled California salmon. The fishermen bring their catch to the market at whatever hour is convenient to them, and the dealers sell for them on a basis of 10 per cent commission. Fish brought in previous to noon must be sold before the market closes the same day, but if brought in after noon it can, if not sold before night, be kept in a cold-storage house close by, and placed on the stalls again the next morning, but in that event it must be distinguished by a small placard bearing the words "Iced fish." The inspector is empowered by law to pass upon all fish before being placed upon the stalls, and can condemn any tainted fish either then or afterwards. It is the usual custom to make frequent inspections of the fish after they go upon the stalls, as they soon become tainted in that climate. No ice is used around the market house. The larger fish are dressed, while the smaller ones are sold round. There is no loss in dressing, however, as the head, entrails, etc., are sold. All except gold-fish are sold dead. This market is exceedingly well managed, and there appears but little, if any, chance for improvement.

The market house at Hilo, which is owned by private parties, was built at an expense of $10,000, including the value of the land, and was opened for business on April 1, 1899. During 1900 the number of stalls occupied was 27, the rents of which varied from $5 to $15 per month. These were not occupied continuously, as frequently a dealer would give up the business after a week or a month's trial and someone else would start in. There are 32 stalls in all. The number of persons employed around the market was 22 Chinese, 18 Japanese, and 14 natives. During the summer of 1901 a syndicate of Chinese and Japanese bought up the stalls and began to take advantage

of their position by shutting out the other dealers and compelling the fishermen to sell to them at a low price, while there was no limit to what they could charge the townspeople, as fish could not be sold on the streets. As a result a number of the fishermen carried their catch by carts to Olaa, about 11 miles away, and established a temporary market there. The territorial government leased the market in August, 1901, which broke up the combination.

An inspector was also appointed, who will have complete charge of everything about the market. Previously there was no inspection and large quantities of tainted fish were foisted upon the people. As at Honolulu, every effort is made to dispose of the catch the same day that it comes in, as no ice is used. Owing to the heavy surf close to the market house, the fishing boats can not land there and are compelled to go to Waiakea, a suburb of Hilo about a mile away. The fishing boats usually land here during the morning and are immediately boarded by the dealers, who begin to dicker for the catch. When a boat with a large catch comes in, a stranger would think that Bedlam had broken loose, as Japanese, Chinese, Portuguese, Hawaiian, English, and variations of these languages are hurled back and forth, each man trying to outstrip every other in the amount of noise made. Everything is on a cash basis, the successful dealer counting down the money at once and removing the fish, which are carried to the market by carriers, with baskets slung over their shoulders on poles, and carts. The principal selling time at the market is in the afternoon, after the dealers have returned from Waiakea.

The market house at Wailuku is a small affair with only 5 stalls, which are run by 2 Chinese and 5 natives, and is owned by a private individual. The market house, with land, is valued at about $1,500. Most of the fish sold here are brought from Kahului, a few miles away, while some amaama come from the island of Molokai. It has no government supervision, which it needs.

The principal market house at Lahaina is owned by the government and is valued at about $6,000, including the land. It contains 6 stalls, which rent at $3 per month. These were run in 1900 by 1 American, 4 Japanese, and 4 natives. Close by are 2 private stalls, which are operated by 4 Japanese. In addition, in 1900, there were 2 private additional fish markets in town, with a total valuation of $650. These contained 6 stalls, which were run by 4 Chinese, 4 Japanese, and 4 natives. The greater portion of one of these was destroyed by fire in the early part of 1901 and has not since been rebuilt. There is no inspector at Lahaina, although one is sorely needed, as the sale of tainted fish, particularly by the Japanese, is quite common. Lahaina is the principal market for the disposal of the fish taken by the fishermen on Molokai and Lanai.

COMMERCIAL FISHERIES.

Commercial fishing is prosecuted on the islands of Oahu, Hawaii, Maui, Molokai, Kauai, Lanai, and Niihau. Fishing is also carried on about some of the smaller islands of the group, but it is done by fishermen from the above-named islands. While the fisheries are of considerable importance now, they could easily be expanded if the proper efforts and attention were given to them. For many years the native Hawaiians held a monopoly of the business, but of late years the Japanese have engaged in it in large numbers. The natives fish spasmodically as a rule, while the Japanese give to it their whole time and attention, and as a result they are doing much better financially than the former. It is probable that the commercial fisheries will be entirely in the hands of the Japanese on certain islands within the next ten years if they increase at the rate they have during the past six or seven years.

A great variety of apparatus is in use in the fisheries, the principal forms being gill nets, seines, bag nets, cast nets, dip nets, lines, baskets, and spears. No effort is made to work the deep-sea fisheries except with hook and line, the greater part of the fishing being done on the reefs or close inshore. It is probable that the beam trawl could be used to advantage in the deeper waters. This apparatus, which is an immense bag, with wide flaring mouth, the bag running to a point at the end, could be worked from the deck of a sail or steam vessel. In working it, long cables are attached to the sides of the mouth and the trawl dropped overboard while the vessel is in motion. The trawl sinks to the bottom, and as the vessel moves forward it is drawn along the bottom and scoops up everything in its path. When it has been down a sufficient length of time the vessel is brought up into the wind, the trawl raised to the deck, where it is emptied, and then dropped overboard for another try.

Sharks are very destructive to nets used in the deeper waters, and also eat the fish out of them; but with the beam trawl it would be impossible for them to do any harm.

Pound nets made of fine wire could be used to advantage on the leeward side of the islands and in the bays. Netting could not be used, as the sharks and larger fishes would tear it to shreds while struggling to get in or out.

Fyke or hoop nets would probably prove profitable in the bays and rivers. They could be set and left without further attention until it was convenient for the fisherman to raise them.

The high prices prevailing for many species forms a very noticeable feature of the industry. In the Honolulu market 25 cents per pound is not an uncommon price for some, while on certain of the other islands even higher prices are realized. Judging solely by this feature, many persons jump to the conclusion that fish are becoming scarce, but this apparently is not borne out by a close investigation of the industry

as a whole. It is but rarely that there is a scarcity of fish in the markets, the principal complaint in this regard coming from those places which are rather inaccessible and where the fishermen are few in number, such as on Kauai. The most plausible reason for the high prices is that fishery products have gone up in correspondence with the other necessaries of life, which are unusually high as compared with the rest of the country. The great development of the sugar industry in the last fifteen years, and the profitable prices realized for the product, have caused a great boom in everything, particularly in the wages paid to labor, and the cost of the necessaries of life has been raised to correspond. It is very probable that as things settle down to a more normal condition the cost of fishery products will be lowered to more nearly their proper level. The Chinese and Japanese have organized companies at several places to monopolize the business, and these have also been important factors in causing the high prices.

The methods of transportation between points on the same island are rather crude in many instances, while in others the cost of transportation is practically prohibitive so far as fishery products are concerned, as a result of which the supply of each place must be drawn largely from its own immediate neighborhood, especially as ice is so expensive that it can not be used to preserve shipments for any length of time. The building of railroads on Oahu and Hawaii has aided very materially in the matter of the transportation of fishery products at reasonable rates. The steamer rates between the various islands of the group are prohibitive at present, and as the distances are too far for small boats there is no opportunity for the fishermen on one island who have an excess to ship to another island where there is a temporary scarcity. These problems will all work themselves out as the means of transportation increase.

Immense quantities of canned, salted, smoked, and dried fishery products, such as salmon, cod, skipjack, mackerel, herring, sardines, shrimps, lobsters, oysters, clams, mullet, etc., are imported and consumed by the people, particularly on the sugar plantations. As these are in many instances located in rather inaccessible regions where fresh fishery products can not be obtained at any price, they are perforce compelled to depend on the prepared goods for their supply.

The bubonic plague broke out in Honolulu in December, 1899, and lasted several months. This proved a serious detriment to the sale of fresh fishery products, as it was thought by many persons that the disease might be transmitted in this way.

The three tables following show in condensed form, by islands, the persons employed, the boats, apparatus, fish ponds, shore and accessory property, and cash capital used in the business, and the catch by species, together with the value of same. The island of Oahu leads all the others in almost every phase of the industry, followed by

Hawaii, Maui, Kauai, Molokai, Lanai, and Niihau in the order enumerated.

The Hawaiians predominate in the fisheries, followed in the order named by the Japanese, Chinese, South Sea Islanders (people from the Gilbert and Marquesas Islands), Americans, Portuguese, and Germans. The shoresmen shown were employed principally in the fish markets. The total number of persons employed was 2,492. This does not include those engaged in carrying on the wholesale fish trade of Honolulu and Hilo.

The total investment in the industry, including the wholesale trade, was $739,741. The shore and accessory property and cash capital employed in the wholesale trade of Honolulu and Hilo are included in this table.

So far as quantity is concerned, the catch of akule was the most important, but malolo leads in the value of catch. Other leading species were amaama, ulua, aku, oio, awa, moano, kawakawa, opelu, opihi, and ula. The total catch amounted to 6,222,455 pounds, valued at $1,083,646.

[The tables on which the preceding remarks are based formed part of the original Congressional document, but as they necessarily occur in Mr. Cobb's statistical report (see pp. 383–499) they are omitted here to avoid repetition.]

COMMERCIAL FISHERIES OF THE HAWAIIAN ISLANDS.

BY

JOHN N. COBB,

Agent of the United States Fish Commission.

COMMERCIAL FISHERIES OF THE HAWAIIAN ISLANDS.

By John N. Cobb,
Agent of the United States Fish Commission.

INTRODUCTION.

On May 1, 1901, the writer was detailed to accompany the party which was to make an investigation of the fish and fisheries of the Hawaiian Islands under the direction of Dr. David Starr Jordan and Dr. Barton Warren Evermann, in order to make a thorough canvass of not only the present condition of the commercial fisheries of the islands, but also of their past history and "the changes in the methods, extent, and character of the fisheries in historic times, as shown by records or traditions, particularly since the coming of Americans, Europeans, and Asiatics." The history of fishery legislation and the possibility of improvements in the present laws were among the questions which received careful consideration.

The investigation of these subjects at the islands occupied a period of three months, during which all of the larger inhabited islands were visited. A careful perusal of all available official and private documents, newspapers, and publications relating to the islands was made, and oral statements were gathered from the older fishermen and others conversant with the subjects in question. I am greatly indebted to the early files of the Honolulu newspapers for much of the historical matter in this report, and especially to *The Friend*, *The Sandwich Islands Gazette*, *The Polynesian* and *The Pacific Commercial Gazette*.

Every courtesy was extended by the officials and citizens of the islands, among whom I would mention the following: Governor Sanford B. Dole, Secretary H. E. Cooper, who was acting governor during the greater part of my stay in the islands; Attorney-General E. P. Dole, Prof. Albert Koebele, territorial entomologist; Dr. J. B. Pratt of the board of health; Prof. W. D. Alexander, of the Coast Survey; Mr. E. R. Stackable, collector of customs at Honolulu; Mr. Joseph Swift Emerson and Mr. W. E. Wall, of the Coast Survey; Miss M. A. Burbank, librarian of the Library Association and of the Historical Society of Honolulu, who placed at my disposal the large collections of both societies; Mr. E. L. Berndt, inspector of the fish market at Honolulu; Mr. F. G. Smith, of the Oahu Railway and Land Company; the officials of the Inter-Island Steam Navigation Company and the Wilder Steamship Company; Mr. S. M. Damon, Mr. Thos. G. Thrum, and Hon. Henry H. Waterhouse, of Honolulu; Mr. W. S. Wise, Mr. J. M.

Hering, and Mr. Carl S. Smith, of Hilo; Mr. J. Storan Moloney and Mr. George H. Dunn, of Lahaina; Mr. E. H. Bailey and Mr. William T. Robinson, of Wailuku; Mr. Francis Gay, of Makaweli, Kauí, and Mr. Thorwald Brandt, of Waimea, Kauai.

Mr. A. H. Baldwin, one of the artists accompanying the expedition, made the pen-and-ink sketches used. All but two of the photographs were taken by myself.

Mr. M. Sindo, of Stanford University, a member of the party, rendered valuable assistance as interpreter with his own countrymen.

PHYSICAL AND GEOGRAPHICAL FEATURES.

The Hawaiian Islands proper comprise a group of twelve islands lying between latitude 19° and 22° 20′ north and longitude 155° and 160° west. Eight of these—Hawaii, Maui, Oahu, Kauai, Molokai, Lanai, Kahoolawe, and Niihau—are inhabited, while Molokini, Lehua, Kaula, and Nihoa are uninhabited, but are occasionally visited by the fishermen. There are a number of small islands and reefs running to the northwestward, which are temporarily occupied by workmen of the guano companies, who collect the eggs and manure deposited upon them by the myriads of sea birds and turtles which resort there. These smaller islands and reefs have a melancholy celebrity in the annals of the islands from the wrecks which have occurred upon them.

The Hawaiian islands have been called the "Key of the Pacific," owing to their location. From Honolulu, the capital, on Oahu, the distance to San Francisco is 2,100 miles; to Auckland, New Zealand, 3,810 miles; to Sydney, New South Wales, 4,484 miles; to Yokohama, Japan, 3,440 miles; to Hongkong, China, 4,893 miles, and to Tahiti, 2,380 miles. There is no land, except a few small islands close to the mainland, between the Hawaiian Islands and the American continent. The islands thus have an immense strategical importance in case of war. Owing to their convenient situation they have become ports of call for numerous steamship and sailing lines running from the mainland to Australia, China, and Japan.

Hawaii.—This island has an area of 4,210 square miles, nearly double that of all the other islands combined. It is 90 miles long from north to south, and 74 miles wide from east to west. This island, which is said by geologists to be the youngest of the group, is composed principally of three enormous volcanoes, two of which are still active. The highest point on the island is Mauna Kea, which is 13,825 feet in height, while Mauna Loa is 13,675 feet high. Both are capped with snow during most of the year. The coast line is regular, sometimes precipitous, but with few bays and no regular harbors. On the eastern or windward side, Hilo Bay is a rather open harbor, which is partly protected from heavy seas by a sunken coral reef. This is the only harbor on the eastern side, as the others are merely landings which can be made only in fairly pleasant weather. On the westward

side are the small bays of Kailua and Kealakeuka, which are safe so long as the winds prevail from the west, which they do most of the year. On the northwest is Kawaihae Bay. Arable land is scattered over a good part of the island, though the frequent volcanic eruptions destroy considerable quantities of good soil by their lava flows.

Kahoolawe.—This island, 6 miles west of Maui, has an area of 65 square miles and is devoted to sheep-raising. Its highest point is 1,130 feet above the sea.

Kauai.—This island is the northernmost of the group, and, according to geologists, is the oldest. It is 63 miles from Oahu, the nearest large island. It has a length of 25 miles, with a breadth of 22 miles, and an area of 590 square miles. In the center is the basaltic mountain called Waialeale, 5,000 feet high. Its northern portion extends nearly to the ocean in lofty ranges, while its southern end slopes gradually to the sea. The northwestern portion of the island has a line of lofty cliffs 7 miles long. The soil is very fertile, as the lava has nearly all decomposed. It is supplied with numerous streams and cascades and has some superb valleys. It has well been named by the inhabitants the "Garden Isle." There are several small bays around the island, but none of them is safe in bad weather.

Lanai.—This is a small island, about 9 miles west of Maui, and is used mainly for sheep-raising. It is 21 miles long and 8 in breadth, and has an area of 150 square miles. At the southeast end there is a mountain 3,000 feet high.

Maui.—This island, lying 25 miles northwest from Hawaii, is the second in size, with a length of 46 and a breadth of 30 miles, and an area of 760 square miles. It is composed of two mountains, connected by a sandy isthmus 7 or 8 miles long by 6 miles across, and so low that the depression of a few feet would make Maui into two islands. Haleakala, the mountain to the northwest, has a height of 10,032 feet, and the volcanic crater at its summit is the largest inactive one in the world. Eaka, the mountain at the southeast of Maui, is 5,820 feet high.

Molokai.—This is a long, narrow island, 40 miles in length and 9 miles wide, with an area of 270 square miles. The western half is an elevated plain 1,000 feet above the sea, without running streams, but covered with grass. At the eastern end are several deep valleys, with streams of water during the wet season. The northern coast is generally precipitous, but near the center is a tongue of land about a mile broad and 10 miles long, projecting into the ocean. In 1865 this was selected as the site for the leper settlement. It is especially well located for this purpose, as behind the point of land is an almost impassable cliff over 1,000 feet high. There are about 6,000 acres in the tract, most of it fertile soil. The Government provides quarters, clothing, and provisions. By law every leper is sent to this place, and none is permitted his freedom. There are two settlements on this point, Kalaupapa and Kalawa.

Molokini.—This island has an area of but a few square acres and is uninhabited. It is situated about midway between Maui and Kahoolawe. Fish are said to congregate around the island in large numbers and it is visited frequently by the fishermen from Maui.

Niihau.—This, the most westerly inhabited island of the group, is 15 miles from Kauai. It has an area of 97 square miles. Two-thirds of it is a low plain composed of an uplifted coral reef and matter washed down from the mountains. The hilly portion is destitute of peaks and ridges. On the side toward Kauai the coast is formed of high cliffs, and from the similarity of the structure of the rocks on the two sides of the strait it is thought that the islands were once united. It is used exclusively for a sheep ranch. Shells of great beauty are found on the shores, which is unusual on the other islands, as there are but few violent storms to throw them up on the beach.

Oahu.—This island is the third in size, but the first in population and importance. It is 46 miles long by 25 miles broad, but has an irregular quadrangular form, with an area of 600 square miles. It is traversed from southeast and northwest by two parallel ranges of hills separated by a low plain. The highest point on the island is Kaala, 4,030 feet. The greater part of the coast is surrounded by a coral reef, often half a mile wide. In several localities an old reef has been upheaved, sometimes to the height of 100 feet, and now forms part of the land. Honolulu, the capital of the islands, is built upon such a reef. The harbor of Honolulu is the only improved one of the coast. It has a depth of 30 feet to the wharves. It had originally a shallow bar at the entrance to the harbor, but a passage through this was dredged some years ago. Pearl Harbor, 12 miles to the west of Honolulu, was ceded to the United States in 1876 upon the execution of the reciprocity treaty with the islands, and is capable of being made one of the best and safest harbors in the world. It has a narrow entrance, and a short distance inside of the entrance the harbor is divided by a narrow strip of the mainland running down the center, into two arms, or branches, which extend back into the island a distance of 10 miles. The depth of water in the harbor is from 6 to 18 fathoms. Just outside the entrance to the harbor is a shallow bar which must be dredged before large vessels can enter.

HISTORY OF THE ISLANDS.

According to Prof. W. D. Alexander, the Hawaiian historian, "there is little doubt that these islands were discovered by the Spanish navigator Juan Gaetano in the year 1555." The Spanish guarded the secret well, as the first intimation the world at large had of their existence was in 1742, when Commodore Anson, of England, captured a Spanish ship and found on board her a map on which was marked a group of islands in their present vicinity. The visits made to the islands in 1778 and 1779 by the English navigator Captain Cook first

brought them prominently in the public eye. He called the group the Sandwich Islands, in honor of his patron, the Earl of Sandwich. Cook visited several of the islands. On his second visit to Kealakeakua Bay, Hawaii, in 1779, he was killed on February 14.

At the time of Cook's visit each island had one or more chiefs or kings. Shortly after the death of Cook a chief named Kamehameha succeeded to the position of high chief of Hawaii, made vacant by the death of the former occupant. He was a man of enlarged views and great force of character. He was quick to see the advantages to be derived from the visits of merchant vessels, and encouraged them in every way possible. He secured firearms from these traders and gradually instructed his people in their use. He also had a small fleet of vessels built, so that he could transport his army rapidly and quickly from island to island. When his plans were ripe he invaded and conquered all the other islands except Kauai, which latter came under his sway through a peaceful cession from the reigning monarch. He established his capital at Honolulu, on Oahu. He died in 1819 and was succeeded by his son, a mild and well-disposed prince, but destitute of his father's energy. One of his first acts was to abolish tabu and idolatry throughout the kingdom. A portion of the people rebelled, but they were soon brought into subjection, and the peace of the islands has been scarcely broken since.

On March 30, 1820, the first missionaries landed at Kailua, Hawaii, from the brig *Thaddeus*, of Boston. The result of their work in the islands has been wonderful. They found the islanders steeped in savagery of the most revolting character. They clothed and taught them, and to-day the average Hawaiian, so far as education and general deportment goes, will compare very favorably with the average citizen of the States. The vices inseparable from civilization, however, have had their effect on the race and it is rapidly dying out.

The government of the islands was monarchical until 1893, when Queen Liliuokalani was deposed. A provisional government was formed on January 17, 1893, with Sanford B. Dole as the head, and this government held power until superseded by a republic on July 4, 1894, Mr. Dole continuing at the head as President. The republic continued in existence, with several slight revolts on the part of the Queen's friends, until annexation to the United States was accomplished on August 12, 1898. On June 14, 1900, the islands were formally organized as a Territory.

FISHERMEN.

Owing to their location between the continents of Asia and America the islands have been securing recruits from each direction as well as from the numerous islands to the south. As, for certain reasons, a sufficient number of suitable immigrants could not be secured from the countries bordering on the Pacific Ocean, Europe has been drawn upon at times, until at present the islands present quite a cosmopolitan

appearance. An idea of the extent of this admixture may be gained from the fact that public notices in the fish markets and other places are usually printed in five languages—English, Hawaiian, Chinese, Japanese, and Portuguese.

In numbers the native Hawaiian fishermen surpass all the others combined, but this is partly because so many women and children engage in the hand fishery for octopus, algæ, etc., and these have been counted in the total. Some of the natives are at the head of quite important fisheries. The Japanese occupy second position in the general total of fishermen and are very ingenious and industrious. They are especially numerous on Oahu and Hawaii, most of them being engaged in deep-sea line fishing, which they virtually monopolize. They have several companies at Honolulu, Lahaina, and Hilo for carrying on fisheries, and in this way control certain lines of fishing, thus enhancing the cost of the products to the general public. Only six Americans have a direct connection with the fisheries, and they principally as managers of the large fishery rights on Kauai and Mauai. The few Chinese fishermen confine themselves to the fisheries immediately along the shores. A few years ago they began leasing the fish ponds still in use on most of the islands, and now have practically a monopoly of this part of the industry. They also quite generally control the selling of fish in the markets. A number of South Sea Islanders, mainly from the Gilbert, Caroline, and Marquesas islands, are engaged in fishing, principally at Honolulu and Lahaina. They are more industrious in this business than the natives and are quite expert. They are the principal users of fish baskets. The Portuguese are not largely engaged in fishing. The Italians have made some efforts in this pursuit, but none is now thus employed.

LAY OF THE FISHERMEN.

When fishing the natives usually make an equal division of the fish taken or of the proceeds among all engaged in it. In a few instances they are hired and paid regular wages.

At Hilo, on Hawaii, in the gill-net and line fisheries the Japanese work on the following basis: The owner of the boat furnishes the boat, lines, nets, etc., and takes 22 per cent of the gross proceeds for the use of these. The balance is then divided equally between the owner and others who participate in the fishery. Should the owner not go out in the boat he does not get anything in the final division.

In the seine fishery at Hilo the owner of the boat and net receives from 30 to 35 per cent of the gross proceeds, this being regulated by the size of the net and boat, while the balance is divided equally among the fishermen, the owner, if he accompanies them, receiving his share with the rest. Should the fishermen work on salary they receive $15 per month, together with their board and lodging.

At Honolulu, among the Japanese fishermen, the owner of a boat used in the fisheries takes 15 per cent of the gross proceeds, the rest

being divided equally among the fishermen. The owner of the boat supplies everything except food, and generally accompanies the boat and gets his regular share with the others.

RELIGIOUS BELIEFS AND SUPERSTITIONS OF THE FISHERMEN.

The Hawaiians are a superstitious race, and at the time of the advent of the first missionaries they had many customs and beliefs which were common to all the islands, while there were others which were local to certain islands and even districts. The fishermen had many which were peculiar to themselves and they formed almost a distinct community. Their small heiaus (temples), often called ku-ulas, stood on almost every promontory, while they could not use a new net, fishing rod, or canoe without prayer and sacrifice to their patron god. Each fisherman had his fetiches, or gods, and these are frequently found from time to time in secret places where they had been hidden in 1819, when idol worship was abolished.

In all the great ceremonies of the state and church the fishermen occupied a prominent place. The following is a description of the part played by the fishermen in the dedication of a new temple:*

On the fourth night another great *aha* (hoowilimoo) was performed by the king and the priest of Lono, while another priest, with a large company of fishermen, put to sea to fish for *ulua*.

Offering of the ulua.—The idols were now invested with white kapa and received their several names, the principal one being called *Moi*; and a great sacrifice was made of hogs, bananas, cocoanuts, red-fish, and white kapa, besides several more human victims, which were placed on the *lele*. If the fishermen failed to catch any *ulua* that night they killed a man in the village and dragged his body to the heiau with a hook in his mouth as a substitute for the fish.

As the *ulua* priest approached, chanting an incantation and carrying his hook and line, everybody fled, and even the priests retired within the drum house. When he had finished chanting his *aha* behind the lananuu, he reported to the king the omens which he had observed, and the fish was offered up to the god. If he had broken his rod or line, or if the bait had all been eaten, it was a bad omen.

The chief god of the fishermen was Kuula, whose worship extended throughout all the islands, and to whom they looked for abundant supplies of fish and other products of the sea. His son Aiai was the first to locate the deep-sea fishing grounds for the fishermen.

On Lanai two large stone images, personifying Laeapua and Kaneapua, deities who were supposed to preside over the sea, were much honored by the fishermen.

On Molokai a shark named Moaalii was famous as the marine god. Many temples were built on promontories for his homage, and to them the first fruits of the fishermen's labors were dedicated. When victims were required in honor of this god, or it was supposed to be hungry, the priests would sally out and ensnare with a rope anyone whom they could catch, who was immediately strangled, cut in pieces,

*A Brief History of the Hawaiian People. By W. D. Alexander, pp. 57, 58; 12 mo., New York, n. d.

and thrown to the voracious animal. Another mode of entrapping the unwary was by uttering piteous cries like a wounded or sick individual. Those attracted to the spot were seized and sacrificed.

A large puhi (eel), called Koona, whose residence was said to be at Wailau, on the Koolau side of Molokai, was deified by the people of that place. It achieved celebrity by killing a large shark which had attacked it, but it was eventually killed by Aiai, the son of Kuula.

Lonoakihi was the puhi god of all the islands. Hinahele and her daughter Aiaikuula were goddesses of the fishermen of Hawaii.

The fishermen of the islands also had a god, Maikahulipu, who assisted them in righting their canoes when they were upset.

The god of the canoe-makers was Mokualii.

The fishermen, to a certain extent, believed in transmigration, and frequently cast their dead into the sea to be devoured by the sharks which infested the shores. Their souls were supposed ever after to animate those fishes, and incline them to respect the bodies of the living should accident or design ever throw them into their power.

The shark occupied a unique position among the people. It was quite generally worshipped on all the islands, each one having a special shark or sharks as their "aumakuas" or ancestral god. The following is a clear and concise account of shark worship in olden times:*

The shark was perhaps the most universally worshipped of all the *aumakuas*, and, strange to say, was regarded as peculiarly the friend and protector of all his faithful worshippers. In the case of the *pueo*, all birds of that species were equally considered as representatives of the *aumakua*, known as "*Pueo nui o Kona*." They were not worshipped as individual owls, and when one died the life of the *aumakua* was in no wise affected. Not so with sharks. Each several locality along the coast of the islands had its special patron shark, whose name, history, place of abode, and appearance were well known to all frequenters of that coast. Each of these sharks, too, had its *kahu* [keeper], who was responsible for its care and worship. The office of *kahu* was hereditary in a particular family, and was handed down from parent to child for many generations, or until the family became extinct. The relation between a shark god and its *kahu* was oftentimes of the most intimate and confidential nature. The shark enjoyed the caresses of its *kahu* as it came from time to time to receive a pig, a fowl, a piece of *awa*, a *malo*, or some other substantial token of its *kahu's* devotion; and in turn it was always ready to aid and assist the *kahu*, guarding him from any danger that threatened him. Should the *kahu* be upset in a canoe and be in serious peril, the faithful shark would appear just in time to take him on his friendly back in safety to the nearest shore. Such an experience, it is said, happened to Kaluahinenui, the *kahu* of a certain shark, while voyaging in the Alenuihaha channel. The schooner was overtaken by a severe storm and was lost with most on board. In her distress Kaluahinenui called upon her shar god, *Kamohoalii*, who quickly came to her rescue, taking her upon his back to the neighboring island of Kahoolawe.

This story of shark intervention and many similar to it are extensively believed at the present day. In Professor Alexander's History, however, where the real facts of this case are carefully stated, no allusion is made to any aid rendered by a shark. His statement is as follows:

"At noon on Sunday, the 10th of May, 1840, the schooner *Keola* foundered and sank a considerable distance west of Kohala Point. As there was a strong current

*The Lesser Hawaiian Gods. Read before the Hawaiian Historical Society April 7, 1892, by J. S. Emerson, esq., vice-president of the society. Papers of Hawaiian Historical Society, No. 2.

running to the northward, the passengers and crew, seizing on oars, boards, etc., swam for Kahoolawe, then about thirty miles distant. A Mr. Thompson, of Lahaina, was drowned, but his wife and two young men reached Kahoolawe the next day. Mauae, of Lahaina, and his noble wife, Kaluahinenui, swam together, each with an empty bucket for a support, until Monday afternoon, when his strength failed. His wife then took his arms around her neck, holding them with one hand and swimming with the other, until she found that he was dead, and was obliged to let him go in order to save her own life. After sunset she reached the shore, where she was found and taken care of by some fishermen, having been thirty hours in the sea." It is interesting thus to learn the facts connected with this modern instance of a case illustrating the popular belief.

The largest and most celebrated of the Hawaiian shark gods was *Kuhaimoana*, a male, whose mouth was said to be as large as an ordinary grass house and could take in two or three common sharks with ease. Most of the channels around the islands of Maui and Oahu were too shallow for his huge bulk. More than once he had the misfortune to get aground, and to avoid this fate he spent most of his time in the deep waters off the island of Kaula.

Second to him in size and power was the shark called *Kamohoalii*, older brother of the goddess *Pele*. Like many of the other shark gods, he was able at pleasure to assume the human form. In that form he dwelt in profound solitude in a most sacred spot called the *Pali Kapu o Kamohoalii* [the sacred precipice of *Kamohoalii*], overlooking the fires of the volcano of Mokuaweoweo.* Another *Pali Kapu o Kamohoalii*, with a like tradition, is similarly situated with reference to the crater of Kilauea. Even *Pele*, fiercest of gods, dared not allow the smoke from her furnaces to trespass on the awful sanctity of her brother's abode. He was also said to make his home in the highest cone in the crater of Haleakala. From time to time he walked among men, when he claimed the well-known prerogative of an Hawaiian god to discard his malo. In his shark form he is still said to roam at large in the deep waters about the island of Maui, and is claimed by many as their *aumakua*.

One reason for the affection shown to the shark *aumakuas* was the fact that so many of them claimed human parentage, and were related by ties of kinship to their *kahus*. Such was the case with *Kaahupahau* and her brother, *Kahi' uká*, the two famous shark gods of the Ewa Lagoon, on this island.† Their birth and childhood differed in no essential features from that of other Hawaiian children up to the time when, leaving the home of their parents, they wandered away one day and mysteriously disappeared. After a fruitless search their parents were informed that they had been transformed into sharks. As such they became the special objects of worship for the people of the districts of Ewa and Waianae, with whom they maintained the pleasantest relations, and were henceforth regarded as their friends and benefactors. After a time the man-eating shark *Mikololou*, from the coast of the island of Maui, paid them a visit and enjoyed their hospitality until he reproached them for not providing him with his favorite human flesh. This they indignantly refused to give, whereupon, in spite of their protest, he made a raid on his own account upon the natives, and secured one or more of their number to satisfy his appetite. *Kaahupahau* and her brother promptly gave warning to their friends on shore of the character of this monster that had invaded their waters. To insure his destruction they invited their unsuspecting guest to a feast made in his honor at their favorite resort up the Waipahu River. Here they fed him sumptuously, and at length stupefied him with the unusual amount of *awa* with which they supplied him. While he was in this condition their friends, who had come in great numbers from the surrounding country, were directed to close up the Waipahu River, which empties into the Ewa Lagoon, with their fish nets, brought for the purpose, while they attacked him in the rear. In his attempt to escape to the open sea he broke through

*The summit crater of Mauna Loa, on the island of Hawaii. †Oahu.

one net after another, but was finally entangled and secured. His body was then dragged by the victorious people on shore and burned to ashes, but a certain dog got hold of his tongue and after eating a portion dropped the remainder into the river. The spirit of the man-eater revived again and, as a tongue, now restored and alive, made its way to the coasts of Maui and Hawaii, pleading with the sharks of those waters for vengeance upon the sharks of the Ewa Lagoon. They meantime secured the aid of *Kuhaimoana* and other notable sharks from the islands of Kaula, Niihau, Kauai, and Oahu.

A grand sight it was to the numerous spectators on shore when these mighty hosts joined combat and began the great shark war. It was a contest of gods and heroes whose exploits and deeds of valor have long been the theme of the bards of the Hawaiian Islands. We can not enter into the details of this story, which, if wrought out, would be worthy of being called an epic. We will only say that in the first great battle the friends and allies of the cruel man-eater were routed by the superior force of their opponents, while the good *Kaahupahau* and her brother long continued to enjoy the affectionate worship of their grateful people. It is said that she is now dead, while her brother *Kahi'ukā* still lives in his old cave in the sea, where he was visited from time to time by his faithful *kahu, Kimona*, now deceased. Sometimes *Kimona* missed his fish nets, when he was pretty sure to find that *Kahi'ukā* had carried them to a place of safety, to preserve them from destruction by hostile sharks.

By some authorities *Kaahupahau* is represented as the mother of *Kahi'ukā*, but as there is always an uncertainty in these matters of shark relationship I will not attempt to settle the point.

When we reflect on the amphibious habits of the Hawaiians and their familiarity with and exposure to the dangers of the sea, it is no longer a matter of surprise that they should propitiate certain sharks, and cultivate the pleasantest relations with them, as a defense against other sharks with whom they may not be on friendly terms.

Apukohai and Uhumkaikai were evil shark gods who infested the waters of Kauai, and fishermen were compelled to propitiate these with offerings. Ukanipo was the shark god of the island of Hawaii.

The leho (cowry) was also a beneficent "aumakua." During the reign of Umi, on Hawaii, over four hundred years ago, the discovery was made of the attraction the cowry had for the hee (octopus), and to this day it is quite generally used in fishing for the latter. The leho will also help its devotee to shore should he be shipwrecked. Should the keeper of a shark god send him on an errand of mischief to one who has a leho god, the leho will blind the shark by clinging to his eyes so that he can not do any harm.

One of the commonest mollusks around the islands is the opihi (limpet). This is sometimes an "aumakua" to a few people, and defends its followers against sharks in the same manner as the leho. It is also supposed to calm the raging surf, thus aiding the fishermen in bringing their canoes to the shore in safety.

An "aumakua" of evil was the enuhe (worm). He was supposed to be a monster living in a cave in the district of Kau, on Hawaii. He fell in love with the daughter of a prominent chief, and would visit her in the evening when his real character could not be discerned. When the fraud was discovered her friends resolved upon his destruction, and with her help succeeded in their design. From his dead body the

loli (sea cucumber, or bêche-de-mer) and other allied forms of marine life were supposed to spring.

The following fishes were also worshipped as aumakuas:

The aawa, the oopuhue [puffer], the ohua, the opae (shrimp), the uu [squirrel-fish], addressed in prayer as *Uu kani po;* the kohala, addressed as *Kane i Kohala;* the humuhumu-nuku-nuku-a-puaa, one of the forms in which the hog god, Kamapuaa, took to the sea when Pele made it too hot for him to remain on land; the hee (squid), addressed as Haaluea; the paoo [blenny], and the puhi (eel). With them we may also mention the wana (echinus) and the loli (sea-cucumber) already referred to. I give this without claiming it to be a complete list.*

Other sacred fish were the aku and opelu. They became so because when the high priest Paao was fleeing from his native land (probably Samoa) to escape the wrath of his brother, who had sent a violent storm to destroy him and his companions, the aku assisted in propelling the canoes against the storm, while the opelu swam around them and broke the waves against his body. After a long voyage Paao landed in Puna, on the coast of Hawaii, and in thankfulness to the two fish which had assisted him he made them sacred.

A few of the stars were worshipped by fishermen. "Sirius, called *Newe* or *Hoku kau opae*, determined the best time for catching shrimp by her rising or setting." Newe and Keoe were known as Na-hoku-hookele-waa (boat-steering stars). The Milky Way, or a portion of it, was called *Na ia* (the fishes), and the expression "Ua huli na ia" (the fishes are turned) indicated the near approach of morning.

Should a fisherman by an unlucky accident injure or destroy any animal held sacred by his family, he was bound to make a feast to the god of such articles as "awa, a pig, fowls, squid, the fishes called aholehole, anae, kala, kumu, and palani, together with kalo, potatoes, bananas, and sugar cane."

When the uiui appears it is taken by the fishermen and people generally as a sure precursor of the death of a very high chief. The same is also said of the alalauwa of Maui. It is possible that this latter is the same fish under a different name.

When fishermen are ready to embark they are greatly exasperated should a person come along and stand indolently gazing at them with his hands behind him. They believe it gives them bad luck.

On Kauai the Japanese fishermen buy most of the turtles taken by the natives in their bag nets and, inscribing some Japanese characters on their backs, let them go free. They claim that turtles so treated will guide them back to land should they be lost at sea at any time.

The anaeholo, one of the mullet family, and the aholehole are not eaten by expectant mothers, as they fear dire consequences to the child should they do so. Nor are they given to children until they are able to pick and eat them of their own accord.

*The Lesser Hawaiian Gods. Read before the Hawaiian Historical Society, April 7, 1892, by J. S. Emerson, esq., vice-president of the society. Papers of the Hawaiian Historical Society, No 2, p. 13.

BOATS.

Canoes.—The native Hawaiians use the canoe exclusively in fishing. Some of these, particularly the older ones, are very handsome in design and workmanship, the old-time native boat-builders having been especially expert in their manufacture. The present generation has sadly deteriorated, however, and the canoes made now by natives rarely show very much skill in design and workmanship.

The body of the canoe is usually hollowed out of the trunk of a koa tree (*Acacia koa*). This tree, formerly quite common, is now rather scarce, owing to the excessive demands made upon the supply for canoe-building and other purposes. It averages from 50 to 60 feet in height. The tree is first cut down, the branches stripped off, and then the trunk is cut to the length desired for the canoe. This trunk is roughly hewn to the shape desired and then brought down to the shore, where the final shaping is done. After the body is finished a rim about 6 inches in height is fastened to the upper part by means of wooden nails. The holei (*Ochrosia sandwicensis*), a tree from 6 to 12 feet in height, is preferred for this, but the ahakea (*Bobea elatior*), a tree 20 to 30 feet in height, is sometimes used.

Each canoe is fitted with an outrigger, made by laying two long, slender poles, slightly curved at one end, across the canoe at about one-fourth of the distance from each end of the latter, and so arranged that on one side they extend a few inches over the side of the canoe, while on the other they run out from 6 to 8 feet. The curved part of the poles is on this side. These poles are firmly lashed to the body of the canoe where they cross it by stout twine. A sapling, about 12 feet long and 6 inches in diameter, is then lashed to the under side of these poles near the extreme ends, the sapling lying parallel to the body of the canoe and extending slightly beyond the cross poles at each end. The wiliwili (*Erythrina monosperma*), a tree 20 to 25 feet in height, is generally employed in constructing the outrigger. The object of the outrigger is to balance the canoe, which is very narrow, when in the water. With ordinary care it is almost impossible to capsize a canoe fitted with an outrigger. The natives often make long journeys in them, frequently in quite stormy weather, and seem perfectly at home in them.

An ordinary canoe for one person would be about 18 feet long and about 17 inches wide, while a three-seated canoe would average 33 feet in length and 21 inches in width.

The paddles have a long, slender handle, usually about 46 inches in length, with an oblong blade about 23 inches long by 13½ inches wide. The wood of the paihi tree is frequently used, especially on Hawaii, in making the ordinary paddles, while the wood of the koaia (*Acacia koaia*) is generally used in the manufacture of the fancy ones.

The Gilbert Islanders on the Hawaiian islands use a slightly

different arrangement of the outrigger. At the ends of the cross poles short forked sticks are lashed with the closed part of the fork upward. The long sapling is then lashed to the lower ends of the forks, but does not enter the V-shaped openings. It does not appear to be as effective an arrangement as the one previously described.

Some of the canoes use sails, but most of them depend upon their paddles for motive power.

During the aku (ocean bonito) fishing season two canoe owners frequently combine forces. In that event the outriggers are removed from the canoes, which are placed parallel to each other at a distance of about 6 feet, and are then held in this position by two cross-pieces running from canoe to canoe at about one-third of the distance from each end and firmly lashed in this position. The sail is operated in only one of the canoes.

Mr. Henry Weeks, of Kona, Hawaii, uses a canoe in the bottom of which is inserted a square piece of thick glass, so that he can locate the bottom fishes and hee (octopus), as he slowly paddles along.

Sampan.—The Japanese use the sampan, a style of boat in general vogue in the fisheries of Japan. These boats are clumsy and awkward-looking, and are poor sailers, although very seaworthy. A sampan to be operated by two men is usually about 20 feet in length on top, with about 6 feet on the keel. The beam is usually about 4 feet 5 inches, while the depth averages 20 inches. They are made of pine. Their most peculiar feature is an overhanging, partly inclosed stern, in which the rudder is worked. The width of the stern is about 3 feet. The gunwale, from the bow for about two-thirds of the length on each side, overhangs nearly 12 inches, and has a plank about 6 inches in height extending above the gunwale. In the bow is a large cubby-hole raised even with the top, in which fishing lines, sails, etc., are stored when not in use. In the center are about 8 compartments—4 on a side, 12 to 15 inches deep, with plugs which can be pulled out in order to allow the entrance of water, thus making live wells. These small holes—about 6 inches long by 3 inches wide—are crossed with small twigs or wire netting to keep the fish from escaping.

Sculling from the stern is the method invariably used by the Japanese. The oar, which is about 13 feet long, is lashed to a handle about 6 feet in length; this gives the oar a slight angle, which makes sculling much easier than if it was all one solid piece. On the handle is a pin, on which a rope is slipped, so that the scull is held down to a uniform height while being worked. The sweep of the stock at the hand end is nearly 2 feet. The fisherman, planting his left foot on an inclined board, sways his arms and body at right angles to the boat.

Quite large sampans, with crews of from 4 to 6 men, are employed in the deep-sea line fishing off Molokai.

The small sampans cost about $75 to $80, without sails; the largest

cost about $150 in the same condition. The sails for the smaller ones average about $7 per boat, and for the largest ones about $15.

Whaleboats.—A few whaleboats are used in the fisheries of certain of the islands, principally by the Chinese. These are of the regulation whaleboat pattern, and have evidently been modeled after boats left behind by the whalers who used to frequent the islands. They average about 25 feet in length, about 5½ feet in width, 26 inches deep, and are sharp at both ends. They cost about $125 each.

Rowboats.—These are of all sizes and shapes, from a small, rectangular pine-board boat, worth $2 or $3, to a handsome, well-built boat costing $25. They are used principally in the rivers, fish ponds, and small bays, where the water is smooth.

Scows.—A few scows are employed in the seine fisheries on Oahu, and are of a rough, cheap character which requires no description.

Seineboats.—These are very much of the same pattern as the best rowboats, only larger and more valuable.

APPARATUS AND METHODS OF OPERATING SAME.

Owing to the proximity of the sea to all of the habitable portions of the islands, and the natural dependence of the people upon the products obtained from it for a considerable part of their sustenance, the natives early developed into expert fishermen and fisherwomen, and as time went on gradually evolved newer and more effective forms of apparatus to take the place of, or to aid, the more primitive forms. The advent of foreigners hastened this development by the introduction of forms of apparatus in use in their own countries and heretofore unknown in the islands. The earlier American settlers, coming as they did principally from New England, where fishing had been brought to a higher state of perfection than elsewhere in the United States, were especially helpful in this regard.

The writer has endeavored to give as complete a list as possible of the forms of apparatus in use, together with the methods of operating the same. As many forms bear native names, while others have names different from those by which they are commonly known on the mainland, every effort possible was made to see each form and witness the methods of operation, and where this could not be done the statements of reliable fishermen and others were taken.

SEINES.

At Hilo the large seines used on the beach average 250 feet in length, with bag 7 feet deep, and mesh of one-half inch. The wings average 4 feet in depth and have a mesh of 1 inch. They are usually made from No. 9 to No. 8 cotton twine.

On Maui seines 150 feet long, 8 to 12 feet deep, with 1½ inch mesh, are used. They have no bag, and several of them are often laced together and used as one net. They are usually hauled up on the shore.

At Pearl Harbor, Oahu, the Chinese use what is practically a purse seine, which is 50 fathoms long, 20 fathoms deep, with a mesh of 1 inch in the center and 1½ inches in the wings. The bottom of the net has rings, with a rope running through them. After the fish are surrounded the lower line is pulled up by the fishermen. The bottom comes up together, thus forming a bag or purse on each side, and this is pulled in until the fish are all in a small bag on each side of the boat, whence they are dipped out by means of small scoop nets.

The bait seines average from 10 to 60 yards in length, with one-half inch mesh or less. They are quite generally used by all classes of line fishermen in securing their bait. No. 3 cotton twine is generally used in the manufacture of these seines.

GILL NETS.

The gill-net is a popular form of apparatus in the fisheries at the present time. They are either set or hauled; rarely, if ever, being drifted. When set they are generally stretched, at high tide, across the shallow openings in the coral reefs. As the tide goes out the fish rush for these openings and become meshed in the net. The fishermen are on the seaward side of the net and pass to and fro, removing the fish as fast as caught. This fishing is carried on at night, and the nets are of varying lengths and depths, according to where fished.

In fishing around clusters of rocks the natives generally surround them with a gill-net. This is held to the bottom by means of leads or pebbles attached to the lower line, while the upper line is supported at the surface by pieces of wood of the hau (*Hibiscus tiliaceus*) and kukui (*Aleurites triloba*), which are very light. The fishermen then dive down to the bottom, inside of the net, and drive the fishes from the crevices of the rocks, and as they dart away in all directions they are meshed in the net. In this kind of fishing nets about 55 feet in length and 7 feet deep are used. When this net is not long enough one or more nets are laced to it.

Gill nets are also used at times along the beaches on the leeward side of the islands, where the surf is not heavy, the same as seines. Two men take hold of one end of a long net and wade out from the shore in a straight line for a considerable distance. The land end of the net is held by a man on the beach. After they have gone out a sufficient distance, the two men make a big sweep to one side and then pull their end of the net to shore a short distance from the other man. The net is then carefully pulled in, the same as a haul seine, until it comes out on the beach, fish and all. These nets are usually 20 fathoms in length, 9 feet deep, with 2-inch mesh, and are fitted with leads and corks. Several of them are usually joined together. No boats are employed when fishing in this manner.

When fishing for ula (crawfish), the same style of net, with a 7-inch mesh, is frequently set around a rock or cluster of rocks in the early evening and allowed to remain there all night. As the ula come out to

feed during the night they become entangled in the meshes of the net. The net is raised in the morning.

Another method is to join a number of nets together, putting in the center the smallest mesh net of all. These are then placed on two canoes, which are rowed to the usual fishing-ground, which is generally not far from the shore. One man stands upright in order to more clearly see where the schools of fish are. As soon as a school has been sighted the boats are paddled to the seaward of it, and when this has been accomplished, they begin paddling in opposite directions, paying out the net at the same time from each boat. After sweeping out a little way the boats are paddled to shore, hauling the net after them. The net is then hauled in, the various sections being removed as they are landed, like a seine, until it is about 50 feet from the beach. The fishermen then spring into the water and draw the two ends together, thus making a circle. One end of the net is then pulled around until the end of a section is reached, when it is removed. This is continued until the fish are all inclosed in a small circle formed by the fine-meshed section. At certain fisheries the net is then anchored and the fish allowed to remain in it until they are wanted for shipment, when they are removed by means of a small seine, swept around inside of this improvised pound; and when the fish have been bagged in this they are removed by small dip nets. The principal species taken in this fishery are the oio (lady-fish), kala (hog-fish), nenue (rudder-fish), and large awa-kalamoho (milk-fish).

A variation of this method is for the boats to move in a circle, and when they meet for one to pass inside of the other; and thus they keep on until there are several rings of netting around the fish. This is so that if they break through the inner ring they will surely be caught in one of the other rings. After the school has been sufficiently encircled the fishermen jump into the inner circle and, beating the water with their canoe poles, frighten the fish into the nets, where they are meshed.

Another method is to drop the nets in a half circle, with a man at each end to hold it thus. The other fishermen then make a wide sweep to the opposite side of the opening, from whence they begin advancing toward the net, beating the water violently with their arms, which drives the fish toward the net. When the beaters have advanced a sufficient distance the men holding the ends of the net advance toward each other with it. When they come together all the fishermen take hold, and the circle is gradually reduced as the net is hauled in and section after section removed. The fish which have become meshed are taken out of each section as it comes in. When the inner circle is small enough the fishermen remove those which are not meshed with dip nets. This fishing is done either in the day or night.

When fishing for akule unusually long nets are frequently employed. At Hilo nets 208 fathoms long, 4 fathoms deep, with mesh of 4 inches,

are used. These are made of No. 12 linen twine and are worth about $100 each. Most of the nets, however, are of about one-half the above dimensions and are worth about $50 each.

On Hawaii, when the school of akule (goggler) arrives a man is posted on the high bank with two flags, one in each hand. When he waves the one in the right hand the canoes on that side move to the right; when he waves the left-hand flag those on that side move to the left, and when he drops both it means to let the net go. From his elevated position he can observe the movements of the school, which owing to the color of the fish looks like a red bank, better than those in the canoes.

Nearly all the seine and gill nets are barked before being used, as otherwise they would soon rot out. The bark of the koa tree is used for this purpose. It is first pounded up somewhat fine and then put in a tank with water, where it is allowed to remain for two weeks. The water is then drawn off into a water-tight box and the nets are slowly drawn through this water.

In drying the nets a method introduced from China is employed at several places, particularly Hilo. Throughout an open field a number of slender poles about 12 feet in height are planted. At the top of each is nailed a crosspiece of wood about 3 feet in length, which is supported by two short pieces running from the pole to the outer ends of the crosspiece. Large hooks are attached to the ends of the cross sections. A short piece of rope is slung over each of these hooks, and when the net is ready for drying one end of this rope is attached to the lines of the net and it is pulled up sufficiently to clear the ground, and held in this position by tying the free end of the rope to the pole close to the ground. This also facilitates the repairing of nets.

BAG NETS.

Bag nets are used on all of the islands, being the form of apparatus in most general use. They are of all sizes and styles, according to the particular species the fishermen are in search of and the condition of the fishing-ground.

Several of the more important private fisheries are worked by means of bag nets. At Kahului, Maui, a net 180 fathoms long, with ropes 250 fathoms long attached on each side, is used. The wings of this net have a mesh of 4 inches, while in the center the mesh is 1 inch. It is operated from the shore by means of two windlasses. The net is laced in the center, and when drawn near the shore a bag 15 feet wide, 18 feet high, 35 feet long, with meshes from 1 inch to 1¼ inches, is attached to the center of the net, after which the net is unlaced and the ends drawn back to the sides of the bag. This is done by divers. If there is only a small haul the bag is drawn directly up on the beach. If many fish have been taken the bag is placed in a canoe and the rope at the bottom of the bag unlaced and the fish allowed to fall into the boat. This net is made of cotton twine.

The bag net in general use is about 20 feet in depth in the bag, 12 feet wide at the mouth, and runs to a point. Wings about 30 feet each in length and about 5 feet deep, with meshes of three-fourths to 1 inch, are attached to each side of the mouth of the bag. Floats made from wood of the hau tree, which is very light, are strung along the upper line of the wings and the bag. Leads are attached to the bottom line. The end of the bag is generally open when on shore, but is tied with a piece of twine before being put overboard; the fish are removed from the bag at this end. The nets are made of Manila hemp, which costs $1.25 per pound, and 9 pounds are required to make a net of the above dimensions. Cotton twine is also used at times. Sections of rope, from 15 to 20 fathoms in length, fastened together with hook and loop, with the dried leaves of the ki plant braided on these ropes by the stems, with the blade ends of the leaves hanging loose and free, are taken out, along with the net, to a favorable spot, the sections of rope are joined together, and men taking hold of each end, and moving in opposite directions, begin to make a sweeping circle. The others follow behind to keep the rope near the bottom, and when it catches on rocks or coral dive down and release it. When the persons holding the ends of the line meet, one steps over the line of the other, and so they keep on going round and round, gradually narrowing the circle, until it has become sufficiently small. In the meantime the various sections not needed in the narrowing circle are unhooked piece by piece and allowed to float on the surface. The bag net is then taken out of the canoe and attached to the ends of two of the sections. They continue narrowing the circle until the fish are all driven into the net, which is then closed up, one of the canoes paddled close to the net, which is lifted into it, the string holding the point of the bag untied, and the fish allowed to drop into the bottom of the boat.

A variation of the above net, but on a larger scale, has been invented by Mr. E. H. Bailey, of Kahului, Maui. A smooth spot of bottom, inside of the reef, in a fairly shallow place, is selected. On this spot the net is arranged. The net is the same as described above, except that it has a net platform in front, which is attached to the mouth of the bag and also to the wings. Two lines of ki leaves are put together so as to make them thicker and thus more effective. Buoys are attached to the rope by means of short lines, and the ropes sunk by leads until the tips of the leaves just scrape the reef. The ropes are run out in a half circle and then pulled over the reef, after which the ends are swung around until they encircle the bag. The ropes are then carried round and round until all of the fish are over the platform, when the latter is raised up and the fish forced back into the bag. As soon as the platform reaches the surface the ropes are withdrawn. The canoes then form a triangle and the mouth of the bag is drawn up between them and the fish taken out with dip nets.

Opelu nets (upena aai-opelu) are arranged on two half-hoops con-

nected at each end; the hoops lap over each other and are tied together so as to keep the bag open when in the water. A rope runs from each of these and meets a short distance above the bag, from which junction there is only one rope. The bag itself is very deep, usually about 40 feet, with a diameter of about 12 feet at the mouth and tapering slightly at the bottom. They are made of imported flax, so as to be as light as possible. The bag is taken out to deep water in a canoe, and when the fishermen reach what they consider a favorable spot they lower the bag into about 8 fathoms of water. Bait, composed of cooked squash or pumpkin, small ground-up fish mixed with sand, and cooked papaia and bananas mashed up fine, is dropped into or over the bag. When the fish are gathered over and in the bag it is carefully and rapidly drawn up, and when it reaches the surface the ropes on the side are unloosed and the mouth closed up. The bag is then emptied into the canoe and the operation repeated until the fish become shy. The opelu, when eaten raw, is said to prevent seasickness.

The native sometimes constructs the above net from twine made from the bark of the olona (*Touchardia latifolia*) bush or shrub. The bush grows in large shoots. These are cut down and the bark stripped off in bundles and put into running water, so that it will not ferment and in order that the pulpy matter, etc., will decompose. It is kept there for four or five days, until it becomes thoroughly clean. It is then taken out and spread on boards of hard wood—kauwila wood generally made expressly for this kind of work. This wood is very scarce and valuable now. These boards are 6 feet long and 8 or 10 inches wide. The strips of bark are spread on the boards and a man cuts out pieces of the inside with a bone, 2½ inches wide and 10 inches long, with one side beveled to an edge. This bone is held tightly in the hands, and with it the natives scrape the bark lying on the board. Everything is scraped away, leaving the fiber perfectly clean. It is then dried and twisted by hand by the women. It is stripped into fine threads, and two threads are twisted together by women rolling them on their bare thighs. This fiber is stronger than linen and will last for generations.

For catching nehu (anchovies and silversides), very small fish much used for bait and for drying as food, a bag net (upena nehu) is made from a piece of netting about a fathom square, attached on two sides to sticks about 3 feet in length, and fulled in the bottom rope shorter than the upper one and forming an irregular square opening to a shallow bag, which is supplemented by a long, narrow bag about 6 feet deep. Ropes hung with dried ki leaves are attached to each side of the net, and these ropes are run around the school, thus driving them into the net.

Nehu fishing is generally carried on in deep water.

A bag net (upena pua) made in the same manner is used for catching amaama, young mullet. Instead of ropes with ki leaves, the "sea

Convolvulus, generally found growing on the beach, is twisted, leaves, branchlets and all, into two thick bushy ropes some 15 to 20 feet in length, and these are attached on each side of the net to the kuku (side sticks); these lines are then drawn forward in a semicircle, sweeping the shoals of fry before them till enough are partly inclosed, when the two free ends are rapidly drawn together in a circle, which is gradually reduced till the fry are all driven into the bag."

A bag net very similar to the above is used in fishing for ohua, a small fish very highly prized by the natives, which lives in and on the limu kala, a coarse alga that grows on coral in shallow water. Long ropes with dried ki leaves are employed, and the method of operation is the same as already described.

A bag net called kapuni nehu is also used in catching nehu. This bag is about 6 feet deep and 3 feet wide at the mouth. Two parallel sticks are used to keep the mouth open. When a school of nehu are seen working their way along close inshore, two men go out with the net, each holding one of the sticks. Others get in the rear of and on the sides of the school and frighten it into the bag. When the fish have gone in, the sticks are brought together, thus closing the bag, which is then hauled ashore or put into a canoe and emptied. These bags are of exceedingly fine mesh and are made of a certain kind of Chinese netting, which is said to be exceedingly strong.

A bag net, called upena uhu, is employed in catching the uhu, some highly prized Labroid fishes, chiefly species of *Calotomus*. This is made of a square piece of netting which has been gathered slightly on the ropes and attached at the four corners to slender strong sticks tied together at the middle in such a way that they will cross each other at this spot and can be closed together when wanted. A string is tied at the crossing place of the sticks and the net is manipulated by this string. When these sticks are crossed they spread the net open in the form of a shallow bag. The fisherman first catches an uhu of the variety to be fished for by means of hook and line. He secures this to a line run through its gills and mouth, and then lowers it at a spot where the uhu congregate and gently works it back and forth. The uhu in the vicinity are attracted and angered by the strange antics of the decoy and swim up close to observe it. The net is gently lowered to a little distance from the decoy, and the latter is then slowly drawn into the net. The others rush into the net after the decoy, when, by a peculiar twitch and pull on the string, the fisherman causes the sticks to swing around and lie parallel, which closes the mouth of the bag, and it is then drawn to the surface and emptied into the canoe and the operation repeated with a fresh decoy.

There are two varieties of uhu, one of a reddish color and the other green. The red variety is preferred by the natives, who eat it raw. This same net is used for other species of rock-fish, in such cases a decoy of the species sought being used.

A similar bag net (upena opule), about a fathom in length and with an oval mouth about 2 or 3 feet in width, is used for catching the opule, a decoy opule being used in the same manner as described above.

Another kind of decoy fishing is with the lau melomelo, the decoy used being a billet of kauwila wood, one of the hardest in the islands. This is something like a club, being rounded at the ends, with one end smaller than the other, and a little ringed knob on the smaller end to tie a string to. It varies in length from 13 inches to 3 feet. After the proper incantations have been performed over it by a sorcerer or kahuna, it is charred slightly over a regulation fire. Having once attained its power great care must be taken by the fisherman that it does not lose it. If a woman should step over it or enter the canoe in in which it is placed the stick would lose its power. Kukuinut (candlenut) and cocoanut meat in equal quantities are baked together. They are then pounded up and tied in a wrapping of cocoanut fiber (the sheath around the stem of a cocoanut leaf). Fishing is usually done in water of not more than 5 fathoms in depth. On arriving at the fishing-ground the stick is covered with the oily juice of the baked preparation and allowed to hang suspended a few feet from the bottom. The scent of the baked nut meat, in the opinion of the fishermen, has an attraction for certain kinds of fish, which soon surround the stick and smell or nibble at it. In a short time a small bag net is dropped overboard, and maneuvered until its mouth is toward the suspended stick. The latter is then moved slowly into the bag, the fish following it. Two of the natives then dive and approaching the net gently, quickly close its mouth and give the signal to those in the canoe to haul it up. Should the fishing prove poor it is ascribed to the imperfect performance of the incantations. This manner of fishing was formerly quite common on the west coast of Hawaii, but is not often practiced now.

One of the common species around the island of Oahu is the malolo, or flying-fish, although but few of these are found around the other islands. There are two species, the large malolo and the small puhikii. In catching them a large bag net with a flaring mouth and very fine mesh is employed. In fishing the net is piled on a large single canoe, or sometimes a double canoe, and the start is always made early in the morning. A number of canoes usually go out together, many of the occupants being women, as no particular skill is required on the part of the general hands. The work is directed by the kilo, or spy, who is generally in a light canoe manned by two or three hands. He stands up on the cross-ties of his canoe, and shading his eyes with his hand, watches for signs of the school. As soon as he discerns a strong ripple, which appears to indicate that the school is there, he signals to the rest of the canoes, which at once surround it. The best place for dropping the net is quickly decided upon and it is then put overboard at the spot indicated by the kilo. When the net is all ready the canoes paddle very quickly in toward it, splashing the water with

their hands and poles, and driving the school before them into the open net. The malolo will not dive to any depth, and are always found swimming very near the surface, so that, when completely surrounded by the canoes, they can be driven wherever wanted. This fishing is called lawaia-o-kaiuli, "blue-sea fishing," by the natives as they frequently have to go several miles out to sea after the fish. A favorite spot is off Waikiki beach. The malolo is frequently pounded up fine by the natives and then mixed with other substances and eaten raw.

The iheihe (a species of halfbeak, *Euleptorhamphus*), a long, thin fish, usually a foot and a half in length, with a very sharp-pointed snout, that generally arrives at the islands about the same time as the malolo and the akule, are sometimes captured in a similar net and in the manner described.

The largest bag net in use is the upena kolo, and owing to its size it can only be used at a few places around the islands, Honolulu Harbor being the principal place. It is an immense bag, from 16 to 24 fathoms in depth, which is very narrow at the extreme end, but widens out into an immense flaring mouth. The bag is fine-meshed, so that the small fishes will not escape. Attached to the mouth of the bag, on each side, are wings 16 to 20 fathoms deep. This net is swept around the harbor by natives in canoes, who pull the net with ropes, and it scoops up everything in its path, the principal species taken being the hahalalu, the young of the akule, and the amaama, or mullet.

Upena poo is a small bag net, with a light supple pole cut from the pohuehue (*Ipomea pes-capræ*) vine for the mouth. This pole forms three-fourths of a circle when not in use. When in operation the fisherman draws the two ends together, crosses them, and holds them tight in his hand. A small stick, with pieces of rag or lau hala leaves attached to the end, is also used. When fishing the native paddles his canoe along until it is immediately over a rocky bottom where holes are numerous, takes the bag in his left hand and the small stick in his right hand, and dives to the bottom. He pushes the bag close up to one of the holes and with the stick brushes the fish from the holes into the bag. He then allows the two ends of the stick to slide down in his hand until the ends lie parallel, and this nearly closes the mouth of the bag, after which he ascends to the surface and empties the bag into his boat.

Another style of net is arranged with two pieces parallel to each other, about 6 inches apart, the bag being about 2½ feet in depth and width. One stick is supple, while the other is rigid. When in use the fisherman pushes the pliable stick along the other until it is about the middle of the latter, and holds it in this position, thus bowing it out and making an opening for the fish. When he wants to close it he merely lets the stick slide back until it is even with the other, when he holds both tight.

Mr. J. S. Emerson, of Honolulu, furnishes the following account of a fishing expedition he made with a native, using a bag net somewhat similar to the two just described.

We started at sunrise from the shore in a little canoe capable of holding two persons. The native had only a malo (breech clout) for his dress. He had with him some of the candlenut (kukui). This he chewed up in his mouth and spat the chewed material on the surface of the water. This produced a film so that he could look down from the now calm surface of the water to a depth of 6 fathoms or more and locate the little caves and holes in the coral where the fish were. When he had discovered the proper location of these fish holes, he laid his paddle down in the boat and took a hand net in one hand. The bag of this hand net was like a purse. There were two sticks to hold it open and these were upon two sides of a triangle; the mouth of the net was tied to the sticks. In the other hand he had a fish brush, a rude fly brush about 3 feet long, composed of a stick to which were tied bits of bark, etc., to make a brush to drive the fish. He sprang into the water—in one hand the net and in the other the fish brush. I noticed sometimes he had it in one hand and sometimes in the other, it apparently did not matter which. He dove down, propelling and guiding himself entirely with his feet, with his eyes wide open, and approached the spot at the bottom, 6 or 8 fathoms deep, with the brush in one hand and the net in the other, ready for work. Then with the one hand he stirred up the fish from their resting-places and drove them into the net as one would drive little chickens. Having secured all the fish from that particular spot he closed his net, held the net and brush in the same hand and used the other hand to paw his way to the surface. On arriving there he blew the water out of his mouth and nose, threw his head back and got into the canoe. He remained below the surface about two minutes. There were in the net 3 or 5 fishes about 6 or 7 inches in length. He then chewed up some more of the nut and proceeded for a few rods ahead, spat out the nut on the water, looked down, and went through the same operations again, finding a few more fish there. This he did for several times, say possibly at a dozen places.

Certain methods of bag-net fishing which were in vogue years ago have been entirely abandoned, or at most are but rarely used. Among these is Lau Kapalili, which was called the "Fishing of Kings," as they only could command a sufficient number of canoes, men, and lau. The late Kamehameha V, whose favorite residence was at Waikiki, frequently ordered it. The following is a description of this fishery:*

Lau Kapalili is the use of a large bag net, smaller than the kolo but larger than the ohua or iiao net, but of the same general shape, and called a papa. Two rope laus of 300 or 400 fathoms in length, with ki leaves attached, the same as in lau ohua, and generally the lau of two or more ohua nets joined, are piled on to a large double canoe, which is taken out 2 or 3 miles from shore, attended by a fleet of from 60 to 100 single canoes. The head fisherman always goes on the canoe containing the net and lau. Arrived at the proper distance, which must be just opposite the final drawing-place, the end of one rope is joined to that of the other, and two canoes, manned by 8 or 10 strong men, take the other end of the rope or lau, one each, and start in opposite directions and exactly parallel with the shore, whilst the double canoe remains stationary till all the lau is paid out. In the meantime the rest of the canoes have divided into two companies and follow the leading canoes, stationing themselves at certain distances on the lau and helping to pull it.

* Hawaiian Fisheries and Methods of Fishing, with an Account of the Fishing Implements used by the Natives of the Hawaiian Islands. By Mrs. Emma Metcalf Beckley. Pp. 18, 19.

When the lau is all paid out the two leading canoes then curve in to form a semicircle, at the same time always moving toward the shore. When a perfect semicircle has been made by the lau the double canoes and all the others move gradually forward with it, while the leading canoes are pulling with all their might straight into the shore. When either end is landed the men immediately leap out, and taking hold of the line pull on it, at the same time going toward each other, which has the effect of narrowing the semicircle, whilst most of the canoes keep backing on to the double canoe, which always keeps the center. Arrived at a suitable place, always a clean, sandy one a few rods from shore, the laus are untied and attached to each end of the papa net. Men, women, and children now gather closely on the lau, especially where it joins the net, and make a great disturbance with their feet, which drives all the fish into the net. Lau and net are finally drawn ashore.

Lau Kapalili (trembling leaves) fishing can only be carried on on a clear, bright, sunny day, so that the shadows cast by the leaves can be seen and serve to drive the fish inland.

DIP AND SCOOP NETS.

It is frequently difficult to distinguish between a dip net and a bag net, as certain forms of each are very similar in construction and methods of operation, and in some cases an arbitrary distinction has been made.

In fishing for maikoiko, a dip net about 6 feet deep and 4 feet in diameter is used. A bag of bait tied to the end of a stick is pushed into the water near the holes in which the fish live, and when they are drawn out by the scent of the bait the dip net is carefully slipped under the bait and fishes and then raised up slowly until it reaches the surface, when it is lifted or drawn ashore.

Another method is to chew up bread fruit and taro and spit these upon the surface of the water. As this slowly sinks below the surface the fish are attracted in large numbers and fall easy victims when the dip net is slipped below them and then quickly raised to the surface.

A common form of dip or scoop net, which is generally used in removing fish from seines and bag nets, is made by bending a flexible piece of wood into an oval shape and tying the ends together at the junction. To this the net, which has a bag about 2 feet deep, much narrower at the bottom than at the top, is attached. When not in use the lower end of the bag is left open, but when used it is gathered together and tied with a piece of twine.

On Kauai a dip net with a bag about 2 feet deep, attached to an iron ring 2 feet in diameter, is used in catching papai or crabs. This net is attached to a long pole by means of four ropes running from the ring to a common center about 2 feet above the ring, and thence by a single rope. The bait is either tied to a rope attached to and hanging down a short distance below the junction of the four ropes, or else weighted down in the bottom of the net. April, May, and June are the principal months for this style of fishing. It is usually done at night. Somewhat similar dip nets are occasionally employed in fishing for ula (crawfish).

The Chinese use a form of dip net on the Waiawa River, near Pearl City, Oahu, which was probably introduced by themselves, as it does not appear elsewhere on the islands. The river is narrow, about 40 feet in width. Four poles are planted, two on the edge of the bank, and the other two about two-thirds of the distance across the river, thus forming a square. All of these poles are slanted outward, so much so that the tips of the outer ones almost extend to the opposite bank. A large, square, fine-meshed net is attached to these poles by ropes. On the shore a windlass is constructed, which is connected with the net by a rope, and this is used in raising and lowering it. When fishing, bait is thrown into the net, which is then lowered down into the water until it almost touches the bottom. It is allowed to remain there until a number of fish have congregated over the net, eating the bait, when it is raised above the surface and the fish removed.

A scoop net is made by tying a square fine-meshed net to two slender sticks, laid parallel to each other and about 5 feet apart. One side of the net is then gathered together until the ends of the sticks on that side are within about a foot of each other, when it is secured in this position. This forms a rude sort of bag at the gathered end. In operating it the two ends of the sticks at the bag end are held in one hand and the flaring end is pushed around stones, etc., in shallow water, thus scooping up the fish, papai, and opai. By lifting the flaring end out of the water the catch falls back into the bag, from whence they are easily removed with the hand. This net is quite generally used around the leeward side of Oahu.

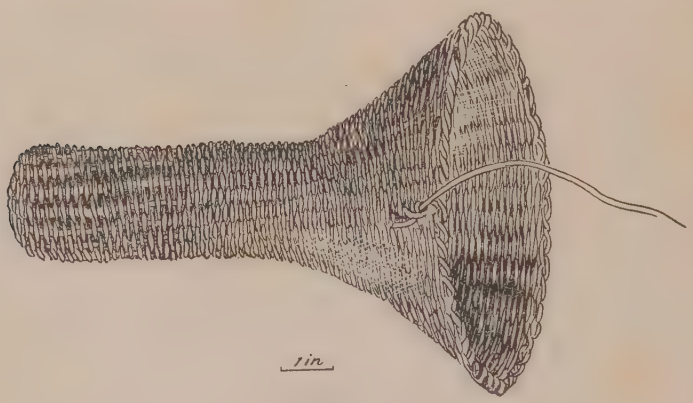
CAST NETS.

The cast net (upena poepoe) is a comparatively recent introduction in the islands, having, so it is reported, been brought in by the Japanese about ten years ago, although this is somewhat doubtful. The nets, which are circular, average about 25 feet in circumference and have 1½-inch mesh. They have leads all around the sides and are made generally of No. 10 cotton twine. They are worked from the shore. Unlike the fishermen in the States, the Japanses hold no part of the net in the mouth, but manipulate it entirely with the hands. About two-thirds of the outer edge of the net is gathered up in the hands of the fishermen, and when he sees a school of fish he throws the net with a sort of twirling motion, which causes it to open wide before it touches the water. The leads draw the outer edges of the net down very rapidly, and as they come together at the bottom the fish are inclosed in a sort of bag. The net is then hauled in by means of a rope attached to its center, the weight of the leads causing them to hang close together, thus preventing the fish from falling out as the net is hauled in. The fish are shaken out of the net by merely lifting the lead line on one side.

BASKETS.

With the exception of baskets (hinau) used in catching opai (shrimps) the natives do not do much in this line, the South Sea Islanders being the principal users of this form of apparatus.

In opai fishing two varieties of baskets are used. One, the hinai opai, sometimes called apua opai, looks somewhat like the coal-scuttle bonnets in vogue some years ago. It is woven from the air roots of the ieie (*Freycinetia arborea*). This is employed when shrimping in the mountain streams, and the work is generally done by the women. When fishing the women hold the basket in one hand, a short stick in the other, and moving in a crouching position through the water, they drive the opai from under the rocks, etc., to a suitable spot, which is always some place where the grass, ferns, or branches of trees droop



Basket for Catching Opai.

over on the water. The opai take refuge in or under these and the fisherwoman, placing her basket under the leaves, lifts them out of the water, when the opai drop off into the basket, from whence they are removed to a gourd, with a small mouth, which the woman has been dragging behind her in the water by a string tied to her waist.

Another method of fishing in the streams is to take a fairly deep basket with a large mouth, and putting this in a favorable spot in the water, build a mud wall on both sides of it and extending out a short distance. The fisherwoman then goes a little ways upstream and by beating the water drives the opai into the basket, which she removes and empties, going on to another place and repeating the operation.

When fishing for opai in salt and brackish water a basket is used with a wide flaring mouth, gradually sloping toward the center, a few inches from which it suddenly branches off into what looks like a long circular spout inclosed at the extreme end. These baskets vary in size and are usually operated by women. Holding the basket in the left hand they wade out in an almost nude condition to a suitable spot,

when they sink down until only the head is visible, and pushing the right hand under the rocks, drive the opai into the basket, which is so manipulated as to partly envelop one side of the stone. The mouth of the basket is closed by drawing the sides together and holding them in this position. The opai are then transferred to a gourd floating alongside, which the fisherwoman keeps from drifting away by a rope tied around her neck and attached to it. The women are expert in this method of fishing and rarely fail to make good catches.

The hinai hooluuluu is used in hinalea fishing, and is a small basket made from the vines of the awikiwiki, a *Convolvulus*. After a light framework of twigs has been first tied together, the vines, twigs and all, are wound in and out, round and round, until of the requisite size, 3 or 4 feet in circumference and about 1½ feet deep. Opai pounded and inclosed in cocoanut fiber is occasionally placed at the bottom of the basket for bait, but usually the scent of the bruised and withering leaves seems to be sufficient. Women always attend to this kind of fishing. They wade out to suitable places, generally small sandy openings in coral ground or reef, and let the baskets down, suitably weighted to keep them in position, the weights attached in such a way as to be easily detached. Each woman then moves away from her basket to some distance, but from where she can watch the fish enter the basket. When all the fish that are in sight have entered, they take the basket up and, transferring the fish to a large small-mouthed gourd, move the basket to a fresh place. Fishing in this way can only be carried on on a calm, sunny day and at low tide.

Baskets made from the awikiwiki must be renewed from day to day. Some are made from the ieie vine, while still others have been made from the weeping willow since its introduction some years ago. These latter can be used over and over again.

Sometimes these baskets are placed in fairly deep water, where stones are piled around them to keep them in position. For bait the wana (sea egg), with the shell broken to expose the meat, is put in it. The basket is left for a day or two before being taken up.

The hinai uiui is used when fishing for the uiui (*Platophrys pantherinus*), a small flat-fish, said to make its appearance at intervals of from ten, fifteen, to twenty years. Its appearance is taken by fishermen and the people in general as a sure precursor of the death of a very high chief. The basket is shallow, of about the same size as the hinai hooluuluu, but wider-mouthed. The following is a description of the methods of fishing followed on the last appearance of this fish:*

At the last appearance of the uiui the imported marketing baskets were generally used by those who could not obtain the old-fashioned kind, as any old cast-away basket would do, with a little patching, occupying perhaps five minutes, and two sticks bent over the mouth or opening from side to side, and at right angles to each

* Hawaiian Fisheries and Methods of Fishing, with an Account of the Fishing Implements used by the Natives of the Hawaiian Islands. By Mrs. Emma Metcalf Beckley.

other, for a handle to which to tie the draw-string. It should be twisted round and round above the jointure with a little of the sea convolvulus (pohuehue) with the leaves on, so as to throw a little shade in the basket to keep the fish from being drawn up to the surface of the water. In these baskets cooked pumpkins, half-roasted sweet potatoes, or raw ripe papayas were placed for bait. The canoes, thus provided, would sail right into the midst of a school of these fish; the basket being lowered a few feet into the sea, the fish being attracted by the scent of the bait would rush into the baskets and feed greedily. As soon as the baskets were full of fish they would be drawn up and emptied into the canoe and then lowered again, with more bait if necessary, and this would go on till the canoe was loaded or the fisherman was tired. These fish are very good eating when they first arrive, as they are fat, with liver very much enlarged; after a month they become thinner, not perhaps procuring their proper food here, and then taste strong and rank.

The following describes a basket occasionally used by the natives:

The ie kala basket is the largest kind of basket used in fishing by the Hawaiians. These are round, rather flat, baskets 4 to 5 feet in diameter by 2½ to 3 in depth, and about 1½ across the mouth. A small cylinder or cone of wicker is attached by the large end to the mouth and turned inward toward the bottom of the basket. This cone or cylinder is quite small at the free end, just large enough for the kala to get in. Immediately below the end of this cone, on the bottom of this basket, is placed the bait, properly secured, which in the case of the kala is limu kala (a coarse, brownish-yellow alga on which this fish feeds and from which it takes its name), ripe breadfruit, cooked pumpkins, and half-roasted sweet potatoes, and papayas. This basket is called the ie lawe (taking basket). The fishermen generally feed the fish at a given place for a week or more before taking any, using for this purpose a large basket of the same kind, without the inverted cylinder, and wider in the mouth, to allow the fish free ingress and egress. After a week or two of feeding they become very fat and fine flavored, as also very tame, and baskets full of fish can be drawn up in the taking basket without in the least disturbing those which are still greedily feeding in the feeding baskets. These baskets are occasionally used for other kinds of fish, substituting the bait known to attract that particular kind, but never with the same degree of success as with kala. (Ibid.)

The Gilbert Islanders living at Honolulu and Lahaina have introduced two new types of baskets. The larger of these has a flat bottom, while the rest is the shape of a half circle, the top gradually sloping to the rear end. These baskets are about 3 feet long, 2 feet high in front, and 1½ feet in height in the rear. The outer framework of the basket projects about 2 inches beyond the front and back. They are made of flexible twigs lashed together with twine. A cone or funnel, 6 to 8 inches in diameter and about 12 inches long, with the end cut off, is inserted at the larger end, the body of the cone being inside of and opening into the basket. At the end of the cone a trap door of wicker-work, about 4 inches square, is fixed in such a manner that it will open by a touch from the outside, but can not be pushed open from the inside. The basket is weighted down by stones or two pieces of old iron run lengthwise of the basket on the bottom and lashed there. In the rear of the basket is a small trap door for removing the fish. In fishing, the basket is taken to a good sandy place in 2 to 4 fathoms of water, where there is plenty of coral or stones handy. The fisherman then dives and places the basket in a good spot, after which he

takes pieces of coral rock and builds them up and around the basket until it is completely inclosed so as to form an artificial dark retreat for the fish. The entrance to the funnel is left exposed, however, and the fish seeing an inviting entrance to a dark place, go on an exploring expedition till they find themselves inside. The basket is left here for from two days to a week, when the stones are displaced, the basket and its contents hauled up into the canoe and emptied out by means of the back door, and the basket replaced in its former position.

Hinai puhi is the other form of basket used by the Gilbert Islanders. It is oblong, about 25 inches wide, 18 inches high in front, and 3 feet long. The top gradually slopes to the rear, where it is only about 12 inches high. A funnel, or cone, about 8 inches in diameter and 10 inches in depth, extends into the basket in an upward direction. This funnel has an opening on its under side which leads down into a square space about one-half the width of the basket. This space, which begins about halfway of the length of the funnel, runs about 5 inches farther into the basket. From this space another funnel, with a narrow slit opening, leads into the body of the basket. The mouth of this funnel is held taut by lines run from it to the sides. Both funnels are constructed of netting, while the rest of the basket is made from the branches of the guava tree. Bamboo is sometimes used for the top, owing to its lightness. The branches are lashed together with stout twine, no nails being employed. It takes about a week to make one of these baskets, but they will last a long time. This form of basket is used for the capture of the puhi, or moray, an eel-like fish quite common around the islands.

FISH TRAPS OR PENS.

On Pearl Harbor, Oahu, two fish traps are used for catching sharks and large akule, opelu, weke (goat-fish), and kawakawa (bonito). The larger, near Puuloa, has two walls which, for a short distance, run out from the shore in parallel lines. Then one of them sweeps out and around, forming a large and almost oval space. A wall is built parallel to the shore and the outer portion of the oval meets it close to one end. The other line from the shore comes out almost to this parallel line and then turns sharply inward for a few feet, and the space between the two, about 4 feet, forms the entrance into the trap. The walls are built of coral. The end of the oval farthest from the entrance is almost bare at low water, while the side next to the gate has about 5 feet of water. At high tide the whole trap is under water. Fish enter the trap at high water and are caught in it as the water recedes, and they are taken out of it at low water by means of a small seine.

SPEARING.

The natives are very expert with the spear in fishing and use it with equal facility either below or above the surface of the water. The spear is usually a slender pole 6 to 7 feet in length, made of very hard

wood, and tipped with a thin piece of iron 1½ to 2 feet in length. Most of the tips are perfectly smooth, but a few have a very slight barb. The spearing of fish is called "Ia O" by the natives.

The spearing of the species inhabiting the rocks in shallow water is carried on under water. Diving to a favorable spot amongst the rocks, the fisherman braces himself in a half-crouching position and waits for the fish to come along. He only notices fish in two positions, those passing before and parallel to him and those coming straight toward him. He aims a little in advance of the fish, as by the time it is struck its motion has carried it so far forward that it will be hit on the gills or middle of the body and thus secured, but if the spear were aimed at the body it would be apt to hit the tail or entirely miss the fish. The spear is generally sent with such force that it goes right through the fish, thus bringing the latter up to the upper part of the spear, where it remains whilst the fisherman strikes rapidly at other fish in succession, should they come in single file as they usually do.

The above-water spearing is generally for oopuhue (the swell-fish, *Tetrodon hispidus*), which is said to be poisonous, hee (octopus), and honu (turtle). The oopuhue is either speared from the walls of the fish ponds or in the open sea.

In the deep-sea line fishing spears with short poles are frequently employed in killing certain species brought to the surface on the lines.

In fishing for puhi the latter are attracted out of their holes with bait and are then speared.

Spears are frequently used in fishing for the hee (octopus), principally by women. This animal generally makes its home in small circular holes in the rocks on the reefs. When the fisherwoman finds a hole that she thinks is occupied she runs the spear into it gently. Should a hee be there it comes out to see what is the matter. When entirely out of the hole the spear is run through it and it is brought to the surface. A smaller spear is usually carried, and with this she pricks or hits it in the head until the animal is stunned or killed, otherwise it might twine around her arms or legs and do some damage.

Honu (turtle) are generally captured by means of spearing from the rocks along the shore where the honu congregate.

DYNAMITING.

Probably one of the most destructive methods of fishing is with dynamite, or giant powder, as it is generally called in the islands. This explosive was first used for this purpose in 1870. A stick of dynamite weighing about a quarter of a pound is capped and arranged with a fuse about 10 inches long. The fisherman usually selects a deep hole, and paddling to within a short distance of it, he lights the fuse and when it has almost burnt to the cap he throws it from him into the hole. When it explodes every living thing within a considerable radius of where it struck is either killed or stunned by the shock. Many fish rise to the surface and are picked up by the fisherman. An

especially destructive feature of this style of fishing is the number of young fishes killed. This method of fishing is prohibited by law, but very little attention is paid to this enactment, as nobody seems to bother about enforcing it.

POISONING.

The law also prohibits the catching of fish by means of stupefying drugs and plants placed in the water. This is called by the natives "hola hola," and is still practiced in many places.

The ahuhu (*Cracca purpurea*), a poisonous weed which grows on the mountain side, is the one generally employed in this fishing. It is gathered and pounded up with sand; the sand is to make it heavier so that it will sink in water. All over the reefs, running a short distance from and generally parallel to the shore, are numerous caves, holes, etc., which form the habitat of many species of fishes. The fishermen take along a small seine and a quantity of the poisonous mixture in one of their canoes. When they arrive at a suitable spot the seine is put into the water and run around the mouth of a cave, or, in the case of an isolated rock, completely around it. This is to prevent the fish from escaping. The fishermen then place some of the mixture into a small bag, and, diving down to the bottom, flirt some of it into the holes. In about ten or fifteen minutes the fish seem to become stupefied and rise to the surface and are lifted into the canoe by means of small scoop nets. They soon recover from the effects of the drug if allowed to remain in water.

The seeds and leaves of the shrub akia (*Diplomorpha sandwicensis*) are also used for the same purpose.

WEIRS.

While weirs are not of commercial importance in these islands, some are used in the mountain streams during the rainy season for taking the oopu, a small fresh-water goby found mostly in these streams, the catch being consumed principally by the fishermen and their families. During the dry season a platform of large logs, placed side by side, is built and placed in the stream at about or just above high-water mark. During the rainy season the streams get very full and the water becomes so muddy with the wash from the sloping ground adjoining the banks that the oopus, who make their homes in water holes, under large rocks, etc., are driven out and carried downstream by the hurrying waters. As the oopus do not like muddy water, they endeavor to keep in the surface water, which is comparatively clear, and are thus swept in immense quantities onto the platform, and from there into a ditch leading out to a plain, where they are gathered up in large quantities. At this season of the year the oopus are highly prized by the natives, as they have a very delicate flavor. This method of fishing is practiced mainly on the islands of Oahu and Kauai.

TORCHING.

Considerable fishing is done with torches at night. The torches are usually made of split bamboos secured at regular intervals with ki leaves or twigs of the naio (*Myoporum sandwicensis*). They are sometimes made of a number of kukui nuts strung on rushes, or the stems of cocoanut leaves, which are then wrapped around with ki leaves so as to make the torch round like a candle. These latter will burn in almost any kind of weather. The natives have a notion that if the torch burns with a pale flame the fishing will be poor, but if it burns with a bright red flame it will be very good.

In shallow water the fish are frequently speared or taken in a small scoop net by the fisherman as he wades around with the lighted torch in one hand and the spear or net in the other.

Sometimes, while the fish is blinded or dazzled by the light, a scoop net is slipped in front of it by one of the fishermen; a companion then gently tosses a stone just back of the fish, which causes it to dart forward into the net, and it is captured. This manner of fishing is called by the natives "lamalama."

Another popular method is to put in the bow of a boat a can filled with inflammable fuel and covered with oil. At night the boat is rowed to a favorable spot, when the fuel is set on fire. When the amaama and others come up to look at the fire, and are fascinated or dazzled by the light, a stick is suddenly brought down on them, stunning or killing them. They are then picked up and put into the boat, which is rowed a little farther on and the operation repeated.

SNARING.

The use of the snare in fishing seems to be confined to Hawaii, the writer not hearing of its use on the other islands. Puhi and ula (crawfish) are the usual species taken in this manner.

In snare fishing for puhi (ahele puhi) a long stick is employed, with a noose arranged at the end, the string working the noose reaching clear to the end of the pole. A bait made of almost any kind of pounded fish or crab is thrown into the water in favorable spots, especially around rocks, where the puhi live in holes and crevices. The noose is slipped up close to one of these holes and when the puhi sticks its head through it in order to reach the bait the line in the hand is pulled, which draws the noose tight to the end of the pole, pinning the puhi's head there and choking it to death, after which it is drawn to the surface.

In fishing for ula (ahele ula), a long pole (to which dead bait has been tied, about 3 inches from the bottom) is put down in the water in front of a hole in the rocks. As the ula comes out of its hole to get the bait, another pole, with a crotch or fork at the end, to both ends of which a noose is fastened, is slipped under its tail and suddenly jerked, which tightens it, and the animal is brought to the surface.

FISHING WITH THE HANDS.

The native men, women, and children are perfectly at home in the water, spending a good portion of their time there. As a result of this they have become exceedingly expert in diving and swimming. Frequently they catch the various inhabitants of the water with their hands, and in some places this has become quite an important source of revenue to them. It is a common sight, in the less densely inhabited regions, to see a stark-naked native man or woman crouching down in the shallow water and feeling around the coral and lava rocks for fish, papai (crabs), and opai (shrimp). Some of the fishermen dive to the haunts of certain species of fishes, and thrusting their arms into holes or under rocks bring out the fish one by one and put them into a bag attached, for the purpose, to the malo or loin cloth. Opai, oopus (gobies), and gold-fish are frequently taken by women with their hands in the fresh-water streams and taro patches, and form a considerable part of their food supply.

In fishing for octopus the native dives to the bottom, and with a stick pokes around in the small holes in which the hee lives. When he touches one it seizes the stick and allows him to draw it out of the hole. When he reaches the surface the native grabs it with his hands and bites into the head, thus killing the animal.

The ula is also frequently taken by the diver with his hands. The fisherman first provides himself with a small bag, which he attaches to his malo. His right hand he carefully wraps up in a bag or a long piece of cloth. This is to prevent the ula from biting him. Diving down to the bottom, he feels around in the crevices and holes among the rocks with his bandaged hand, pulling out the ulas he finds and putting them in the bag, returning to the surface whenever necessary. Frequently he will bring up two or three at a time. Sometimes the fishermen are severely bitten by puhis, which at times make their home in the ula holes.

Nearly all the mollusks are gathered by hand. The opihi (limpet), which attaches itself to rocks, is detached by knives. The bêche-de-mer (sea slug), wana and ina (sea eggs) are also taken by hand.

The varieties of limu (algæ) which are eaten by the natives are all gathered by hand, and this forms quite a profitable business for a number of women and children on the various islands.

LINE FISHING.

Fishing with rod, hook, and line (called by the natives "Paeaea") is not practised to any considerable extent commercially, except for aku (bonito). In this fishing, mother-of-pearl hooks, made from the shell of a mollusk, now quite rare, are used. These hooks are called pa, and as they glisten with an iridescence like the shimmer from the scales of the smaller kinds of fish on which the aku lives, no bait is needed.

The shell portion of the hook is barbed on the inner side with bone, and two tufts of hog's bristles are attached to the barbed end at right angles to it, for the purpose of keeping the inner side up, so that the shell will lie flat on the surface of the sea. The bone portion of the hook is usually a dog tusk, but sometimes a piece of human bone, ivory, or tortoise shell is used. An iron hook, with the curved portion bent over so far that the point runs almost parallel with the shank, is sometimes used. Brass hooks are also employed at times. In this fishing double canoes are generally employed, as it is easier to fish with them, and much safer, as the fishing is done a considerable distance from shore.

The first object when the fishing-ground is reached is to find a school of aku. The fishermen usually do this by watching the sea gulls. When they hover steadily over one spot it is a pretty sure sign that there is a school of aku there. It is the habit of the fish to run against the tide, and as soon as the school has been sighted the

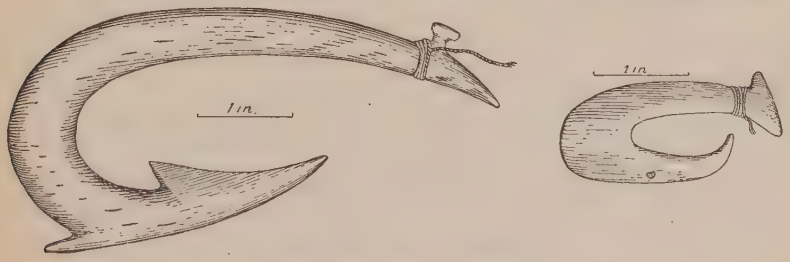
Pearl Hook used in Aku Fishing.

canoes are worked around in front of it, and the fish are drawn close to the boat by the fishermen throwing out a handful or two of the small live bait they have with them. These small fish are usually the nehu, iiao, and the young of various species. There are three men in each canoe, but only one man in each engages directly in fishing, the others managing the canoes. These two men stand up in the stern of their boats, holding in their hands a bamboo pole about 12 feet long, with a line of the same length attached. The pearl hook is tied to the end of this line. By a quick movement the line and hook are slapped violently on the surface of the water and then drawn toward the boat. The aku are attracted by the noise, and seeing the glittering hook, which looks like a young fish, make a spring for it. As soon as the fish is hooked the line is swung up over the fisherman's head so as to make almost a complete revolution. It is very necessary that the line should be kept taut, as, owing to the fact that the hook has but a slight barb, the fish would shake itself loose should the line slacken in the least. As the hooked fish is describing this revolution the fisherman

swings around to meet it, and as it nears him he bows out his right arm, and as the fish comes between his arm and side, closes them up and the fish is caught, unhooked, and dropped into the boat. If he perceives that the fish is coming toward him in such a shape that it will be difficult to hold it in the manner described, he moves out of the way and allows the fish to make another revolution and catches it on its return. The fishing must be done in from ten to fifteen minutes' time, as the school soon gets frightened and disappears.

In paeaea fishing for other species besides the aku, opai, earthworms, and live fry of fish are used as bait. Hooks of varying sizes and kinds, made from ivory, tortoise shell, and human and animal bones are used. Frequently the fisherman takes a handful of opai and, after baiting his hook, bruises the remainder, and, wrapping it up in cocoanut fiber, ties it with a pebble on the line and close to the hooks. The bruised matter spreads through the water when the line is dropped and serves to attract the fish to the vicinity of the hook.

In uhu fishing the gall bladder of the hee is dried and then cooked



Bone Hooks used in Fishing.

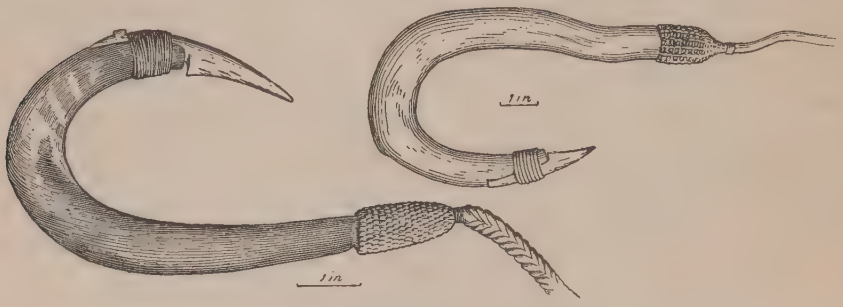
until it becomes a jelly. This is placed in a small calabash or bowl and tied to the hook as bait. A pole is used in this fishing.

In fishing for aama (crabs) from cliffs or high rocks a long bamboo pole with line, to the end of which is tied an opihi, is used. The fisherman dangles this bait in front of the crab as it looks out from its home in the rocks, and the latter at once seizes it. By a quick jerk the line is swung up and the aama caught.

In the deep-sea fishing hooks and lines are used without rods, except for the aku. Fishing is carried on here to depths as great as 600 feet. The older native fishermen are familiar with all the reefs and rocky elevations for miles in every direction from the shore, and know well the different species of fishes to be found in each place. Frequently they go entirely out of sight of the lowlands and mountain slopes, and take their bearings, for the purpose of ascertaining the reef or rock which is the habitat of the fish they are after, from the relative positions of the different mountain peaks.

On Hawaii an ingenious method of fishing for ulua is practiced. A long pole is planted on the shore in such a position as to lean decidedly

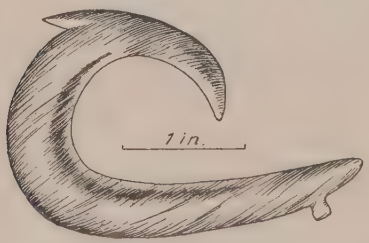
toward the water. On the top of this a bell is arranged so that it will swing clear of the top of the pole. In olden times a calabash with shells inclosed took the place now occupied by the bell. A block and fall is also attached to the pole close to the top, and a long line, with hook at the end, is run through the block and allowed to float out to sea, the land end being tied in a slipknot to the bottom of the pole and the surplus coiled at the foot. A small dead fish is used as bait. In order to attract the fish, puhi are mashed up with sand and thrown into the ocean. As soon as a fish is hooked his struggles cause the bell to ring,



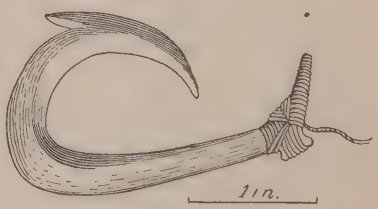
Wooden Shark Hooks, with Bone Joints.

thus warning the fisherman, who at once runs to the pole and, loosening the slipknot, begins to play the fish. As the fish is too large and strong to haul in alive, it must be played until drowned.

In hand-line fishing from canoes in deep water a line of about $\frac{3}{8}$-inch cord, with a lava stone weighing several pounds as a sinker, is used by the natives. A little above the sinker, and for a distance of about 6 feet, there run out from the line little bamboo canes about a foot in length, in a horizontal position, and from the outer ends of these canes



Tortoise-shell Hook.



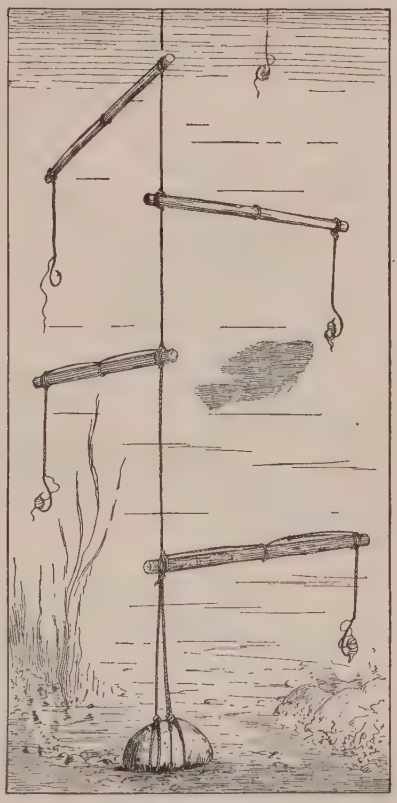
Ivory Hook.

a short piece of line, with a hook at the end, dangles. The bait is put over the point of the hook and the upper portion of it tied to the shank by means of two small threads hanging from the line and tied just above the hook. This line is used in water as deep as 200 fathoms. As soon as the sinker reaches the bottom the native, by a peculiar jerk, disengages the stone and draws the line about a fathom from the bottom, where it is allowed to remain until a certain number of bites have been felt, when it is drawn to the surface, the fish removed, the

hooks rebaited, a new sinker put on, and the line run overboard again. Ulaula is the principal species captured.

In deep-sea fishing the Japanese generally use but one hook on a line, and this is attached to the end of it.

In fishing for mahimahi (dolphin) the Japanese use a rope about 2,000 feet in length. At intervals of 60 feet are attached branch lines about 60 feet in length, with a hook attached to each. Akule are used as bait. When fishing, the line is paid out from the boat, the main line being kept on the surface by buoys made from the cotton tree, while the branch lines hang downward. The line is set in the morning and taken up at noon, the fishermen lying off in their boats in the meanwhile. This fishing is carried on about 10 miles offshore.

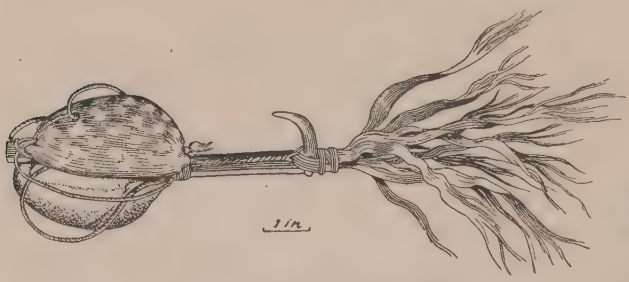


Deep-sea Fishing Line.

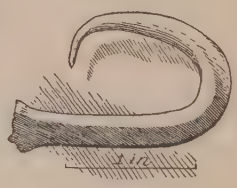
A line with a piece of lead tied in a horizontal position to the end of the line, at each end of which is attached a short line with a hook, is used principally for catching kole. The gall of the hee, prepared in one of the numerous ways given under the heading of "Baits," is used for bait. This manner of fishing is called by the natives "okilo hee."

The native is a great lover of the hee, and has a number of methods of capturing it, one of the most interesting of which is with the cowrie shell. One or more cowrie shells of the Mauritiana or Tiger varieties are attached to a string. When only one is used an oblong pebble of about the size of the shell is tied to the face of it, a hole is pierced in one end of the back of the shell, through which a line is passed, and after being fastened here a few inches of the line is allowed to hang below the shell, to which a hook, whose point stands almost perpendicular to the shaft or shank, is attached. Only shells with small red spots breaking through a reddish-brown ground have an attraction for the hee, and they will not rise to any other kind. Whenever the natives have a shell with suitable spots but with a wrong-colored back-ground, they secure the desired hue by slightly steaming the shell over a fire of sugar-cane-husks. On arriving at the fishing-ground

the fisherman either chews up and spits on the surface a mouthful of candlenut meat, which renders the surface of the water glassy and clear, or uses the water glass, which is described elsewhere. He then drops the shell into the water, and by means of the line swings it back and forth over a place likely to be occupied by a hee. The moment the greedy animal perceives the shell an arm is shot out and the shell seized. If of a kind attractive to the animal, after a few moments' hesitation another arm is placed around it, and this is continued until at last the animal withdraws itself entirely from its hole and hugs the shell closely to its body, and seems oblivious of everything else. The fisherman then draws it rapidly up through the water. When its head comes above the surface the animal raises it, and then the fisherman pulls it over against the edge of the canoe where he hits it a blow between the eyes with a club, which generally kills it. Owing to the animal's quickness with its eight tentacles or arms, the fisherman has to be very rapid in his movements, as the animal would be no mean antagonist should it have an opportunity to seize the fisherman with its arms. The natives say that a number of persons have



Cowrie Hook with Shell for catching Hee.



Hook made from iron nail.

lost their lives in struggles with these animals. This method of fishing is called by the natives "Lawaia hee me ke leho" (squid catching with cowrie).

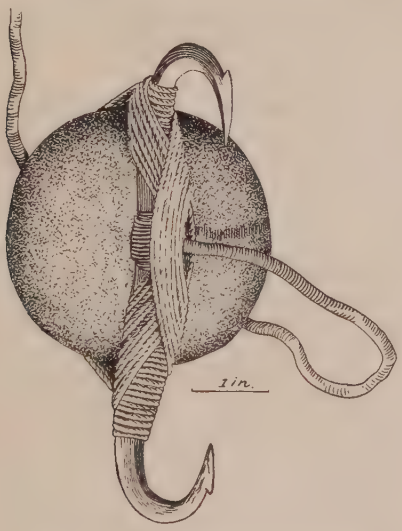
In fishing for hee a cowrie shell, with a metal hook laid across the mouth of the shell and fixed in position with melted lead, is sometimes used; and, again, a line with a piece of lead attached to the end in a horizontal position, a hook with the point up being lashed to one of the ends of the lead, is employed.

Water glasses are frequently used along the Hawaiian coast. An oblong, square box with a piece of glass fixed in the bottom, is put on the water, with the glass end downward, and the fisherman, by placing his face in the open end, can distinctly see the bottom although the surface may be broken with ripples outside of the water glass. The water glasses now in use could be much improved if the box were wide enough to allow the entrance of the whole head instead of merely the face. By inserting the whole head the sunlight is cut off, thus much improving the seeing. A water glass similar to that used in the sponge

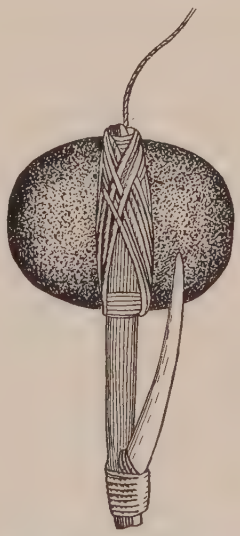
fisheries of Florida would be very effective. This is an ordinary bucket with the bottom removed and a pane of glass substituted.

In fishing for honu (turtle) a flat stone with two hooks lashed to the upper part, and running out in opposite directions, is used. This is attached to a long line. Hee are also caught with this style of apparatus occasionally.

In fishing for papai (crabs) the younger generation frequently use short lines, with a small wooden buoy at the top and a piece of bait (meat, fish head, or any other dead bait) at the end. These are set in shallow water close to the shore, and are frequently lifted by the children who wade out to them, and who grasp with their hands the crabs clinging to the bait before they become frightened and let go.



Hooks used in catching Turtle and Squid.



Hook with Ivory Barb and Wooden Shank.

SHARK CATCHING.

The shark has always occupied a unique position in not only the religious but in the daily life of the native. Its connection with the people in a religious sense is treated of in another part of this report, this present chapter being devoted to methods of shark catching by the fishermen.

The natives distinguish the sharks frequenting Hawaiian waters into five species. The mano-kihikihi (hammer-headed shark) and the lalakea (white fin) are considered edible. The hammer-headed shark is the one most frequently seen in the markets. The others are the mano kanaka (man shark), the shark god of the ancient Hawaiians; the mano, a large white shark, and the niuhi, the largest and fiercest of all. The last two are but rarely seen in Hawaiian waters. The niuhi is said to be seen a long way off at night by the bright greenish light of its eyeballs. It is much feared by the natives.

The mano-kihikihi and the smaller lalakeas are generally taken in gill nets, seines, or bag nets, together with other fishes. The larger lalakea and the other species are taken with hook and line, as no net would be strong enough to hold them. Shark hooks are generally made of a piece of hard wood carved in the shape of a hook, with a piece of sharp-pointed bone lashed to the end of it in order to form the tip. But few of the hooks seem to have a barb, and it speaks well for the dexterity of the fishermen that they succeed so well in fishing with these.

Sometimes the native seeks the shark in coves and caves below the surface after the fish has gorged itself and sleeps with its head forced into the sides of its resting-place. The diver gently slips a noose around the tail of the shark, which is then hauled up and dispatched. Experts have been known to capture six or eight sharks in one day in this manner.

In the olden times the catching of the niuhi was made a great event, but there has been no regular fishery for it for nearly one hundred years. The following account of the manner of its capture is especially interesting:*

The common kind of shark was caught in vast quantities, and the liver, with a little of the flesh, was wrapped in ki leaves and baked underground, then from fifty to a hundred of the largest single and double canoes were loaded with baked meat and large quantities of the pounded roots of awa, mixed with a little water, and contained in large gourds. The fleet would sail many miles out to sea in the direction in which the niuhi is known frequently to appear. Arrived at a comparatively shallow place, the canoe containing the head fisherman and the priest and the sorcerer—who was supposed to be indispensable—would cast anchor; meat and the baked liver would be thrown overboard, a few bundles at a time, to attract sharks. After a few days the grease and scent of cooked meats would spread through the water many miles in radius. The niuhi would almost always make its appearance after the third or fourth day, when bundles of the baked meats were thrown as fast as it could swallow them. After a while it would get comparatively tame and would come up to one or other of the canoes to be fed. Bundles of the liver with the pounded awa would then be given to it, when it would become not only satiated, but also stupefied with awa, and a noose was then slipped over its head, and the fleet raised anchor and set sail for home, the shark following a willing prisoner, the people of the nearest canoes taking care to feed it on the same mixture from time to time. It was led right into shallow water till it was stranded and then killed. Every part of its bones and skin was supposed to confer unflinching bravery on the possessor. The actual captor, that is, the one who slipped the noose over the niuhi's head, would also, ever after, be always victorious. This shark's natural home is, perhaps, in the warmer waters of the equator, as the Gilbert Islanders, now here, make the assertion that it is very frequently seen and captured at their group. The tradition here is that it is only seen just after or during a heavy storm, when the disturbed waters perhaps drive it away from its natural haunts.

The use of human flesh as bait was in great vogue among the Hawaiian chiefs. It was cheaper than pig, was equally acceptable to

* Hawaiian Fisheries and Methods of Fishing, with an Account of the Fishing Implements used by the Natives of the Hawaiian Islands. By Mrs. Emma Metcalf Beckley.

the shark, and gave the chief an opportunity to kill anyone whom he disliked. The victim was cut up and left to decompose for two or three days in a receptacle. Kamehameha I was a great shark-hunter and kept his victims penned up near the great heiau (temple) of Mookini, near Kawaihae, Hawaii.

NEW FORMS OF APPARATUS PROPOSED.

It is probable that the beam trawl could be used to advantage in the deeper waters around the islands. This apparatus, which is an immense bag, with wide flaring mouth, the bag running to a point at the end, could be worked from the deck of a sail or steam vessel. In working it long cables are attached to the sides of the mouth, and the trawl dropped overboard while the vessel is in motion. The trawl sinks to the bottom, and as the vessel moves forward it is drawn along the bottom and scoops up everything in its path. When it has been down a sufficient length of time the vessel is brought up into the wind, the trawl raised to the deck, where it is emptied, and then dropped overboard for another trial. Sharks are very destructive to nets used in the deeper waters, and also eat the fish out of them; but with the beam trawl it would be impossible for them to do any harm.

Pound nets made of fine wire could be used to advantage on the leeward side of the islands and in the bays. Netting could not be used, as the sharks and larger fishes would tear it to shreds while struggling to get in or out.

Fyke or hoop nets would probably prove profitable in the bays and rivers. They could be set and left without further attention until it was convenient for the fisherman to raise them.

BAIT.

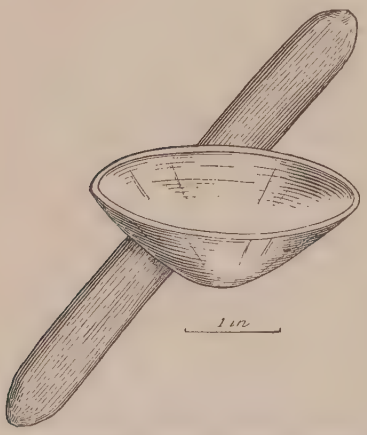
Catching of bait.—The natives generally use live bait in the line fisheries, and their method of catching it is rather interesting. In the morning a medium-length fine-mesh seine is loaded in the canoe or canoes, each containing two or three men, Those in the canoe paddle along about 40 or 50 feet from the shore. One man is left on the land, and he runs along the rough, rocky shore with a small pail of dried opai. Every little while he takes out a few of these, and chewing them in his mouth a few moments spits them into his hand and then throws them on to the surface of the water, a short distance from the shore. If no fish rise to the bait thrown out, it is quite certain none is there, and he runs on a little farther and repeats the operation. When fish rise to the surface and nibble at the bait he signals to the canoemen, who immediately paddle in close to the spot, and all but one, who is left in the boat to maneuver it, drop overboard with the seine and sweep it around the spot, inclosing the fish.

On most of the islands the nehu is the principal species of bait fish taken, while on Hawaii the piha is also used for the same purpose. The young of many other species are also taken in these seines and used as bait, thus working great havoc to the general fisheries.

Bait used.—Live opai are very frequently used for bait in the line fisheries.

All species of young fish are used as bait, both alive and dead, though the former are preferred. In fishing for mahimahi (dolphin) young akule (called agi by the Japanese) are used.

The natives are very expert in the preparation of palu, or baits, from various substances. In making these a small section of the sharp end of a cocoanut shell, about 1½ inches in height, and a small stick of hardwood are used. These two objects are used in the same manner as a mortar and pestle.



Mortar and pestle for mixing palu (or bait).

The following methods of preparing such baits with the ink bag of the hee, or octopus, as the principal ingredient were given to me by Mr. Joseph Swift Emerson, of Honolulu, who has made a thorough study of the native customs: Alaala hehe (the ink bag of the common octopus) is roasted on the coals in the leaves of a ki plant, and when well cooked is ground into a paste in the mortar. Usually it is flavored with something that is supposed to attract the fish. Great care is taken in compounding the mixture, and every fisherman has his favorite recipe.

The following are some of the more common mixtures used, alaala hehe forming the base in every case:

1. Pound up a little alaalapuloa root in the mortar, throw away the fiber, leaving only a few drops of juice in the mortar, then mix in the alaala hehe, working it thoroughly with the pestle.
2. Mash up a red pepper and throw seeds and pulp away, leaving only a few drops of juice adhering to the mortar.
3. Obtain juice from puakala (the prickly plant, the thistle) seeds. Mix in a little salt and proceed as in No. 1.
4. The same with ilima flowers and salt, always using an exact number of flowers, say 4 or 8. The fishermen have a superstitious idea that if an odd number is used it will have no force.
5. The same with salt and young noni leaves slightly roasted.
6. The same with salt and maile kaluhea.
7. The same with salt and leaves of the paina (poha—cape gooseberry).
8. The same with salt and very young leaves of koko.
9. The same with the bark from the root of pilo (plant growing near the sea shore with beautiful flower of foul smell).
10. The same with salt and the bark from root of naunau.
11. Mix with kukui (candle nut) nuts, well roasted, the kukui nuts to be well ground first and then the alaala hehe to be worked in.
12. Mix with old hard cocoanut burnt to a crisp, a little kukui nut rarely done and salt.
13. Mix with a little cinnamon.

14. Mix with fruit of mokihana, which grows on Kauai.
15. Mix with a few drops of brandy or other intoxicating liquors.
16. The same with Perry Davis pain killer.
17. The same with kerosene oil.
18. The same with tobacco juice.
19. The same with juice from ahuhu seeds.
20. Mix with salt and coal from burning a little mahuna kapa.
21. Mix with salt and coal from the sugar cane of the variety known as ainako.
22. Salt the alaala hehe before roasting.

The bait, when prepared, is applied to the tip of the hook and is very attractive to fish. Fishes caught with it are usually small ones found near shore.

In fishing for opelu, cooked squash, pumpkin, papaia, and bananas, also fish ground up fine and mixed with sand, are employed.

The following additional varieties of bait are used in fishing for different species: Kukui and cocoanut meat baked together in equal quantities, chewed bread fruit and taro, opai dried and pounded, wana with shell broken to expose the meat, half-roasted sweet potatoes, raw ripe papaia, pounded papai, fresh and dried opai, earthworms, opihi, the gall of the hee, puhi pounded up fine with sand, nehu, iiao, akule, scraps of meat, fish heads, etc.

Bait boxes.—As live bait is generally used in the fisheries, suitable boxes for keeping it are necessary. The following are the styles in general vogue:

When two canoes are joined together for the aku fishing, a bait box about 20 feet long, 2 feet high the whole length, and about 16 inches wide in the center, and running to a sharp point at each end, is used. It is perforated with numerous small holes on both sides for the free admission of water. When ready to leave for the fishing-grounds the fishermen swing this box beneath the cross-pieces holding the two canoes together and lash it there. In this position about two-thirds of the box is under water. On the return homeward, as it is empty, the box is unlashed and placed on top of the cross pieces, thus making it easier to carry, as it does not impede the progress of the canoe as when swung below. When the aku fishing is over it is either hauled out on the land until the next season, or moored close to shore in a sheltered position and used for keeping bait in temporarily, but is not taken out to the grounds, as it is too big and unwieldy for one canoe to handle. Much smaller boxes of the same general style are frequently employed, also square and oblong boxes of varying sizes, perforated, or with slats set close together.

The Japanese frequently use small boxes about a foot long by 8 inches wide by 8 inches deep, perforated on the sides and ends with small holes. These are attached to the boat by a short piece of twine and allowed to tow alongside.

Some of the Japanese also use one of the smaller of the wells in the bottom of their sampans for carrying the bait.

VESSEL FISHING.

When one considers the fine fishing-grounds in deep water and on the reefs and shoals within reasonable distance of the islands, it is surprising that there are no vessels engaged in the fisheries at the present time. Several attempts have been made to establish vessel fisheries, but for various reasons they have met with failure.

The last attempt was in 1898, when a number of persons in Honolulu formed a company and had the gasoline schooner *Malolo* built, at a cost of $6,600, to engage in this business. She was fitted out with six seines and one bag net, at a cost of $1,000, and carried a crew of four men, the captain, John M. Sass, of Honolulu, an engineer, and two sailors. The fishermen were Japanese, who were hired at Honolulu. They had their own boats and lines, and the schooner towed them to the fishing-grounds. A station was established at Palaau district, on Molokai. An old fish pond was purchased there, the purpose being to clean it out and use it for catching fish which came in through the entrance. The intention of the company was to hire fishermen on the islands to work the nets, while the Japanese would engage in line fishing, and the schooner would make regular trips to Honolulu with the catch. The fishing was to be done on the reefs about the west and south sides of the island of Molokai. The Japanese were very unreliable, as when the vessel was away they would go to Lahaina and other places and sell their catch.

Another fishing crew, composed largely of white men, mostly beachcombers, was gathered together and taken out to the fishing-grounds to work the nets principally. As they knew nothing of the business, they were a failure from the very beginning.

The third fishing crew, composed of native Hawaiians and South Sea Islanders, was secured at Lahaina. Twelve of these men were put on the island of Lanai, and were supplied with boats, nets, lines, and provisions by the vessel. After a few hauls the vessel left for Honolulu with the catch, the understanding with the fisherman being that they were to continue fishing until the vessel returned, so that she would have a cargo to take back to Honolulu. When the vessel returned half of the fishermen had deserted and the few remaining were carried to Lahaina. The whole business was abandoned in August, 1899, after the failure of an effort to get another gang on Maui.

Captain Sass says there was no lack of fish at any time, and if the fishermen could have been properly trained to the work the experiment would have been a brilliant success. Most of the fishing was done with trolling and hand lines, as the nets would not work well on the coral reefs, frequently tearing, while the numerous sharks about the reefs would do much damage to them.

FISH PONDS.

The most interesting of the fishery resources of the islands are the fish-ponds. This is the only place within the limits of the United States where they are found on such an immense scale and put to such general and beneficent use. The time of the building of many of these ponds goes back into the age of fable, the Hawaiians, for instance, attributing the construction of one of the most ancient, the deep-water fish-pond wall at the Huleia River on Kauai, to the Menehunes, a fabled race of dwarfs, distinguished for cunning industry and mechanical and engineering skill and intelligence. Many of the very old ponds are still in practical use and look as though they would last for centuries yet. As the ponds were originally owned by the kings and chiefs, it is very probable that most of them were built by the forced labor of the common people. There is a tradition amongst the natives that Loko Wekolo (Wekolo pond), on Pearl Harbor, Oahu, was built about 250 years ago, and that the natives formed a line from the shore to the mountain and passed the lava rock from hand to hand till it reached the shore where the building was going on without once touching the ground in transit. As the distance is considerably over a mile, this speaks well for the density of the population at that time.

The ponds are found principally in the bays indenting the shores of the islands, the common method of construction having been to build a wall of lava rock across the narrowest part of the entrance to a small bay or bight of land and use the inclosed space for the pond. They were also built on the seashore itself, the wall in this case being run out from two points on the shore, some distance apart, in the shape of a half-circle. Most of the Molokai fish ponds were built in this manner. A few were constructed somewhat interior and these are filled by the fresh-water streams from the mountains or by tidal water from the sea carried to them by means of ditches. Most of the latter are on Oahu, near Honolulu. The Nomilo fish pond at Lawai, on Kauai, is formed from an old volcanic crater with an opening toward the sea, across which a wall has been built, and as the opening is below the surface of the sea the tide plays in and out when the gates are opened.

In the sea ponds the walls are about 5 feet in width and are built somewhat loosely in order that the water can percolate freely. The interior ponds have dirt sides generally, although a few have rock walls covered with dirt, while others have rock walls backed with dirt. The sea ponds generally have sluice gates which can be raised or lowered, or else which open and close like a door. In the interior ponds there are usually two small bulkheads with a space about 8 feet square between them. Each of these has a small door which usually slides up or down. When the tide is coming in both doors are opened and the fish are allowed to go in freely. When the tide turns the doors are closed. When the owner wishes to remove any of the fish he generally opens the inner door when the tide is ebbing. The fish rush

into the narrow space between the bulkheads, from which they are dipped out by means of hand dip nets. In the sea ponds the gate is opened when the tide is coming in and when it turns it is closed.

There is usually a small runway, built of two parallel rows of loosely piled stones from the gate to about 10 feet into the pond. As the fish congregate in this runway when the tide is going out, it is very easy to dip out the supply needed for market. Seines and gill nets are also swept around the inside of the ponds at times in taking fish from them, and as they are quite shallow this is done easily.

The sea ponds usually contain only the amaama, or mullet, and the awa. In the fresh and the brackish water ponds gold-fish, china-fish, oopu, opai, carp, aholehole, and okuhekuhe are kept. Practically no attempt at fish-culture is made with these ponds. Besides the fish which come in through the open gates, the owner usually has men engaged at certain seasons of the year in catching young amaama and awa in the open sea and bays, and transporting them alive to the fish ponds. They are kept in the ponds until they attain a marketable size, and longer frequently if the prices quoted in the market are not satisfactory. They cost almost nothing to keep, as the fish find their own food in the sea ponds. It is supposed that they eat a fine moss which is quite common in the ponds.

There are probably not more than one-half the number of ponds in use to-day that there were thirty years ago. There are numerous reasons for this, the principal ones being as follows:

1. The native population is dying off rapidly, and where there were prosperous and populous villages in the early years of the last century there is practically a wilderness now. Owing to this depopulation there would be no sale for fish in the immediate neighborhood of the ponds there, the only place where it could be sold owing to the difficulty in transporting fish any distance without the use of ice, and the ponds would naturally be allowed to go to decay, the walls breaking down from the action of storms, and the sea filling them with sand when they are located on the immediate shore. This condition of affairs is especially prevalent on Molokai.

2. Two of the important crops of the islands are rice and taro. As both must be grown in a few inches of water, and are very profitable crops, a number of the interior ponds were turned into rice fields and taro patches. Oahu has shown the greatest changes in this regard.

3. On Hawaii ponds were filled up by the volcanic lava flows of 1801 and 1859. The Kamehameha fish pond, which was filled up in this manner in 1859, was said to have been the largest on the islands. Only traces of it are now to be found on the beach.

4. At Hilo, on Hawaii, some ponds, mostly quite small, are so filled with the water hyacinth that it is impossible to work them any more. This year a few of the best of these were cleaned out, but as there is

very little money to be made out of them, and their ownership is in dispute, there is but little desire to do much to build them up.

5. Other ponds have been filled up to make way for building operations and for other purposes. This is especially true of ponds in and around Honolulu and Lahaina. There used to be a number of fish ponds on Lanai, but they have all been allowed to fall into decay.

A number of ponds are kept up by their owners merely as private preserves, as it were, the fish taken from them being either consumed by the owner's household or given to friends. These are scattered all over the islands.

The following is a rough list of the fish ponds still in existence, or traces of which remain, together with their area and a statement so far as possible of their present condition. There is no great claim to accuracy in this list, as many of the ponds are in inaccessible regions of the islands, and in such cases the writer was obliged to depend upon others for reports as to their present condition:

Island of Oahu:	Area in acres.
Koolau Bay:	
*Heeia Pond, near Heeia	88
*Halekou, near Mokapu	92
*Nuupia, near Mokapu	215
*Kaluapuhi	24
*Name not known, in Keaalau	3
*Name not known, in Mahinui	11
*Mikiola Pond, adjoining Mikiola	1.8
*Loko Keana, at Waikalua	3.5
*Loko Waikalua, at Waikalua	11
*Punaluu Loko	12.5
*Pond adjoining Jim Old's	2
*Waikapoki (Alapai), wall broken	4
*Kanohuluiwi	2.5
*Kalokohanahou, at land of same name	7
*Kikiwelawela, in Kikiwelawela	4.5
*Mokolii Pond, adjoining Kualoa	124.5
*Name not known, in Kahana	14
*Kaelepulu, fresh-water pond, in Kailua	216
*Maunalua, in land of same name, partly filled	523
*Wailupe, in land of same name	41.5
Pearl Lochs:	
*Pouhala, in Waikele, remnant leased	22
*Kaaukuu, in Waikele	41
*Maaha, in Waikele	48
*Mokuola, in Waikele	23
*Eo, in Waipio, partly filled	137
*Name not known, in Waipio	5.7
*Hanaloa, in Waipio	195
*Moo, in Waiawa	13
*Kuhialoko, in Waiawa	133
Nameless pond	28
*Apala, in Waiawa	76
*Paauau, in Waiawa, partly filled	320
*Weloko, in Waimano	21
*Kukona, in Waimano	27
*Luakahaole, in Waiau	1
*Paakea, in Waimalu	12
*Opu, in Kalauao	10.5
*Paaiau, in Kalauao	2.3
*Kunana, in Halawa, partly filled	25
*Loko Muliwai	4
*Kahakupohaku, in Halawa	3
Amana, in Halawa, filled up.	
Pohaku, in Halawa, partly filled	2.5
*Name not known, in Halawa, partly filled	5
*Okiokiolepe, in Puuloa	6
*Kapamuku, in Puuloa	3
*Waiaho, in Halawa	32
Moanalua and Kahauiki:	
Lelepaua, in Moanalua, mostly filled up	332
*Kaihikapu, in Moanalua	258
*Kaloaloa, in Moanalua	36
*Awaawaloa, in Moanalua	8.8

Island of Oahu—Continued.	Area in acres.
Moanalua and Kahauiki:	
*Mapunapuna, in Moanalua	40
*Kaikikapu, in Moanalua	20
*Weli, in Kahauiki	30
Kalihi and Kapalama:	
*Apili, in Kalihi	28
*Pahou nui, in Kalihi	26
*Pahou iki, in Kalihi	14
*Auiki, in Kalihi, partly filled	12
*Ananoho, in Kalihi	52
*Kuwili I, in Kapalama	10.5
*Kuwili II, in Kapalama	17.7
Kewalo and Waikiki:	
Ponds, in Kewalo proper, all being filled up.	
Opu, in Miki, now used as rice field	1.31
*Kuwili, in Kalia	9.7
*Name not known, in Kalia	2.5
*Name not known, in Kalia	1.4
*Name not known, in Kalia	1.5
*Kaipuni Pond, in Kalia	1.5
*Kaipuni Pond 2, in Kalia	1.3
*Paweo 1, in Kalia	13.1
*Paweo 2, in Kalia	2.9
*Kapuuiki, in Kalia	1.5
*Kaihikapu, in Kalia	12.2
*Pau Pond	1.45
*Maalahia, fresh water, Waikiki	2.1
*Opukaala, fresh water, Waikiki	1.7
*Kapaakea, Waikiki, fresh water	6.0
Waialua:	
*Ea Pond, in Kamananui	2.48
Island of Molokai:	
Nameless pond at Waiakane, in Kaluakoi, about	15
Nameless pond near Waikane, in Kaluakoi, about	16
Pakanaka, in Iloli	43
Nameless extensive pond, in Hoolehua, filled with mud.	
Nameless extensive pond, in Palaau, filled with mud.	
*Punalau, in Naiwa	20
Ooia, in Naiwa	15
Kaluaapuhi, in Naiwa	22
Kahokai, in Kalamaula	20
Ohaipilo, in Kalamaula	39
Nameless pond, in Kalamaula	2
Nameless small pond inland, in Kalamaula	.9
Kalokoeli, in Kamiloloa	27.6
Nameless pond, in Makakupaia 1	46
Kaoaini, in Makakupaia 2	9.3
Kanoa, in Kawela	50
Hokahaia, in Kawela, partly filled up	31
Uluanui, in Makolelau, partly filled up	6.5
Kawiu, in Makolelau, partly filled up	15

* Used commercially.

Island of Molokai—Continued.	Area in acres.
Panahaha', in Makolelau, walls broken.	36
Kanukuawa, in Kapuaokoolau, walls broken	30
Pahiomu, in Keonekuino	20
Nameless pond, in Keonekuino	10.5
*Kamahuehue, in Kamalo'	37
Nameless old pond, in Wawaia, wall broken	40
Kalokoiki, in Wawaia, partly filled	6
Paialoa, in Puaahala	35
*Kainaohe, in Kaamola, wall partly broken, but used	17
Papaililili, in Kaamola, walls broken	6.5
*Hinau, in Keawanui	54.5
Nameless old pond, in Keawanui, walls broken	35
Nameless old pond, in Keawanui	13
Nameless old pond, in Ohia 1	8
*Puhaloa, in Manawai	6
*Nameless old pond, in Ualapue	3
*Nameless old pond, in Ualapue	19
*Nameless old pond, in Kaluaaha	11
*Nameless old pond, in Kaluaaha	9
*Kaopeahina, in Kaluaaha	20.5
*Niaupala, in Kaluaaha	33.5
*Pipio, in Mapulehu	14
Panahaha', in Pukoo, wall broken	15
*Ilae's Pond, in Pukoo	25
*Nameless pond, in Kupeke	30
*Nahiole, in Ahaino 1	1
*Kihaloko, in Ahaino 2	5
*Waihilahila, in Kailiula	3.5
*Kulaalamihi, in Honomuni	6
Ipukaiole, partly filled up	1.7
Nameless old pond, in Kainalu, walls broken	19
Kahinapohaku, in Moanui, walls broken	4
Ohalahala, in Kumimi, wall broken	1.5
Nameless old pond, in Honouliwai, wall broken	.5
Island of Kauai:	
*Nomilo pond, in Kalaheo	19.5
*Nameless fish pond, in Waimea.	

Island of Kauai—Continued.	Area in acres.
*Nameless fish pond, in Lihue.	
*Nameless fish pond, in Lihue,	
*Nameless fish pond, in Lihue.	
*Nameless fish pond, in Hanalei.	
*Nameless fish pond, in Hanamaulu, area small.	
Island of Maui:	
Kanaha' Pond, near Kahului, not used	37
Mokuhinia in Lahina, mostly filled up, not used	11.4
Nameless pond, in Waiokama, near the last, not used	1
Puuolu, in Pauwalu, Koolau, used as rice field	1.5
Island of Hawaii:	
In Hilo:	
Nameless pond, in lower part of Kukuau	.5
Waiolama Pond, in lower part of Kukuau	.10
Nameless pond, in lower part of Kukuau, filled with water hyacinth.	
*Hoakimau, in Waiakea	1.9
*Waiakea, in Waiakea	25.5
*Mohouli, in Waiakea	4.5
*Kalepolepo, in Waiakea	1.5
*Waihole, in Waiakea	.5
*Kanakea, in Waiakea, sea pond	2
*Lokowaka, in Waiakea, sea pond, almost as large as Waiakea.	
In Puna:	
Name not known at Waiakolea	18
Ponds at Kapoho sunk by subsidence of the coast in 1868.	
Ihukapu, in Kula	3.5
In North Kona:	
Paaiea Pond, in Hamanamana, filled up by lava flow of 1801.	
Pond in Kiholo, filled up by lava flow of 1859.	
Kaloko Pond, near Kailua, partly filled with lava	50

* Used commercially.

NOTE.—I am especially indebted to Prof. W. D. Alexander, superintendent of the coast survey, Honolulu, for valuable assistance in preparing this list.

Owners of ponds rarely have much to do with the practical working of them, as they usually lease them to Chinese who attend to everything. Most of the ponds on Oahu are controlled by two Chinese merchant firms in Honolulu, who work in close harmony. They take particular care that the Honolulu market never becomes overstocked with amaama and awa, and are thus enabled to command almost any price they please during certain seasons of the year when amaama are not to be had. This falls quite heavily on the white population, as they are the principal consumers of the amaama.

The maintenance of these ponds should be encouraged as much as possible, as they are of great assistance in keeping up a regular supply of certain species at all seasons of the year.

The tables following show, by islands and districts, the number and nationality of the persons employed, the number and value of the fish ponds and boats, the number, kind, and value of apparatus employed in the ponds, the catch by species, and the catch by apparatus and species, together with the values of same.

The island of Oahu leads in every particular, having 74 fish ponds valued at $148,850, and employing 142 persons. The total investment

for the island is $150,761. Molokai is second, with 15 ponds, valued at $11,425, 27 persons employed, and a total investment of $11,709. Kauai and Hawaii follow in the order named. The total investment in the pond fisheries for all of the islands is $168,943.

The total catch for Oahu is 560,283 pounds, valued at $139,714; Molokai is second, with 91,919 pounds, valued at $22,980. The total catch for all the islands is 682,464 pounds, valued at $167,041, of which 485,531 pounds, worth $119,202, are amaama.

The gill net is the leading form of apparatus used, 404,537 pounds, valued at $97,819, being taken in these. Dip nets, seines, and scoop nets follow in the order named.

Table showing, by islands and districts, the persons employed, the number and value of fish ponds, boats, and apparatus used in the pond fisheries of the Hawaiian Islands in 1900.

Items.	Hawaii.		Kauai.								Molokai.	
	Hilo district.		Koloa district.		Lihue district.		Waimea district.		Total.			
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Fish ponds	4	$1,200	1	$400	4	$3,900	1	$800	6	$5,100	15	$11,425
Fishermen:												
Americans	1											
Chinese	8				6				6		20	
Hawaiians	2		3				2		5		7	
Total	11		3		6		2		11		27	
Boats:												
Rowboats	4	20	2	30	4	40			6	70		
Whaleboats											1	100
Apparatus:												
Haul seines											1	50
Gill nets	5	25	1	10	4	43	1	5	6	58	14	134
Grand total		1,245		440		3,983		805		5,228		11,709

Items.	Oahu.												Grand total.	
	Ewa district.		Kona district.		Koolauloa district.		Koolaupoko district.		Waialua district.		Total.			
	No.	Value.	No.	Value.	No.	Val.	No.	Value.	No.	Val.	No.	Value.	No.	Value.
Fish ponds	24	$56,480	32	$58,650	1	$400	16	$32,920	1	$400	74	$148,850	99	$166,575
Fishermen:														
Americans													1	
Chinese	28		43		2		38		2		113		147	
Hawaiians	29										29		43	
	57		43		2		38		2		142		191	
Boats:														
Rowboats	5	100	11	220			5	180			21	500	31	590
Whaleboats													1	100
Total	5	100	11	220			5	180			21	500	32	690
Apparatus:														
Haul seines			3	90			2	80			5	170	6	220
Gill nets	26	520	13	260			15	300	1	20	55	1,100	80	1,317
Dip nets			16	60	2	8	22	66			40	134	40	134
Scoop nets			10	7							10	7	10	7
Total	26	520	42	417	2	8	39	446			110	1,411		1,678
Grand total		57,100		59,287		408		33,546		420		150,761		168,943

Table showing, by islands, districts, and species, the yield of the pond fisheries of the Hawaiian Islands in 1900.

Species.	Island of Hawaii.		Island of Kauai.								Island of Molokai.	
	Hilo district.		Koloa district.		Lihue district.		Waimea district.		Total for Kauai.			
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Aholehole	200	$30										
Amaama	1,473	368	2,300	$345	15,900	$2,385	3,600	$540	21,800	$3,270	89,700	$22,425
Awa			700	70	3,914	391	495	50	5,109	511	2,219	555
Carp					1,500	150			1,500	150		
Okuhekuhe	180	18										
Total	1,853	416	3,000	415	21,314	2,926	4,095	590	28,409	3,931	91,919	22,980

Species.	Island of Oahu.												Grand total.	
	Ewa district.		Kona district.		Koolauloa district.		Koolaupoko district.		Waialua district.		Total for Oahu.			
	Lbs.	Value.	Lbs.	Val.	Lbs.	Val	Lbs.	Val.	Lbs.	Val	Lbs.	Val.	Lbs.	Val.
Aholehole													200	$30
Amaama	48,525	$12,131	109,768	$27,442	1,542	$385	212,215	$53,054	508	$127	372,558	$93,139	485,531	119,202
Awa	33,410	8,352	45,380	11,089	115	29	107,864	26,965	64	16	186,843	46,460	194,171	47,526
Carp													1,500	150
Gold-fish							80	10			80	10	80	10
Okuhekuhe													180	18
Oopu	492	74									492	74	492	74
Opai	310	31									310	31	310	31
Total	82,737	20,588	155,158	38,540	1,657	414	320,159	80,029	572	143	560,283	139,714	682,464	167,041

Table showing by islands, districts, apparatus, and species the yield of the pond fisheries of the Hawaiian Islands in 1900.

[The data shown in these tables are given in the general statistical tables shown elsewhere.]

Apparatus and species.	Island of Oahu.											
	Ewa district.		Kona district.		Koolauloa district.		Koolaupoko district.		Waialua district.		Total for Oahu.	
	Lbs.	Value.	Lbs.	Val.	Lbs.	Val.	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.
Seines:												
Amaama			25,000	$6,250			11,000	$2,750			36,000	$9,000
Awa			6,511	1,378			7,000	1,750			13,511	3,128
Total			31,511	7,628			18,000	4,500			49,511	12,128
Gill nets:												
Amaama	48,525	$12,131	18,000	4,500			120,329	30,082	508	$127	187,362	46,840
Awa	33,410	8,352	8,000	2,000			60,718	15,179	64	16	102,192	25,547
Oopu	492	74									492	74
Opai	310	31									310	31
Total	82,737	20,588	26,000	6,500			181,047	45,261	572	143	290,356	72,492
Dip nets:												
Amaama			58,000	14,500	1,542	$385	80,886	20,222			140,428	35,107
Awa			30,260	7,565	115	29	40,146	10,036			70,521	17,630
Gold-fish							80	10			80	10
Total			88,260	22,065	1,657	414	121,112	30,268			211,029	52,747
Scoop nets:												
Amaama			8,768	2,192							8,768	2,192
Awa			619	155							619	155
Total			9,387	2,347							9,387	2,347
Grand total	82,737	20,588	155,158	38,540	1,657	414	320,159	80,029	572	143	560,283	139,714

Table showing by islands, districts, apparatus, and species the yield of the pond fisheries of the Hawaiian Islands in 1900—Continued.

Apparatus and species.	Island of Kauai.							
	Koloa district.		Lihue district.		Waimea district.		Total for Kauai.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:								
Amaama	2,300	$345	15,900	$2,385	3,600	$540	21,800	$3,270
Awa	700	70	3,914	391	495	50	5,109	511
Carp			1,500	150			1,500	150
Total	3,000	415	21,314	2,926	4,095	590	28,409	3,931

Apparatus and species.	Island of Molokai.		Island of Hawaii (Hilo district).		Grand total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:						
Amaama	8,000	$2,000			44,000	$11,000
Awa					13,511	3,128
Total					57,511	14,128
Gill nets:						
Aholehole			200	$30	200	30
Amaama	81,700	20,425	1,473	368	292,335	70,903
Awa	2,219	555			109,520	26,613
Carp					1,500	150
Okuhekuhe			180	18	180	18
Oopu					492	74
Opai					310	31
Total	83,919	20,980	1,853	416	404,537	97,819
Dip nets:						
Amaama					140,428	35,107
Awa					70,521	17,630
Gold-fish					80	10
Total					211,029	52,747
Scoop nets:						
Amaama					8,768	2,192
Awa					619	155
Total					9,387	2,347
Grand total	91,919	22,980	1,852	416	682,464	167,041

PREPARATION OF FISHERY PRODUCTS.

With the exception of a small quantity dried for their home use, and, on several islands, for market, the fishermen sell everything in a fresh condition. The Chinese and Japanese, however, buy considerable quantities of fish from the fishermen and prepare these, usually in a dried condition. Most of this work is done on Hawaii, the district of Kona being especially noted for its dried fish.

The nehu, while one of the smallest of the many species found around the islands, is the one usually dried by the dealers. Large pieces of bagging are spread on ground and exposed to the full rays of the sun, and the nehu, in round condition, are laid on these to dry. When prepared they are placed in tubs and carried around the islands on carts, and are generally sold to the Chinese and Japanese for about 25 cents per pound.

The piha, a fish about the same size as the nehu, is frequently prepared in the same way on Hawaii.

The general method of preparing the larger fishes is as follows:

The fish are split open from the back, except in the case of the opelu, which is opened from the belly, and the entrails removed. The fish are not washed before salting, as it softens them and they are apt to spoil. The larger fishes are scored along the side. They are then lightly salted and put in a container, where they are allowed to remain over night. In the morning the fish are taken out, the salt shaken off of them, and they are then put in a pan of fresh water and the salt thoroughly washed off, after which they are placed upon rude racks or boards, covered with cocoanut leaves, and allowed to remain there until the sun thoroughly dries them. They are put under cover at night. When thus prepared they will keep for some time. Opelu, amaama, akule, and aku are the species usually preserved in this manner.

In preparing the ahi (albacore) it is cut up in squares of about a pound each. These pieces are not scored at some places, owing to blowflies, but where the blowfly is not common they are scored. The pieces are kneaded in salt until almost as round as a baseball and are then put out to dry.

A considerable quantity of amaama was dried on Kauai during 1901, but it was all condemned when it reached the Honolulu market, owing to the alleged careless manner in which it had been prepared. It is very probable that with proper care a considerable trade could be built up by the fishermen who live in localities from whence fresh fish can not be shipped.

Limu (*Algæ*).—The natives are great lovers of limu, and the gathering of it for market forms quite a profitable business for numbers of women and children. In preparing it for market it is rolled into a ball 2 or 3 inches in diameter, the water squeezed out, and a little salt sprinkled on it. Many varieties of limu are found around the islands, but only a few are used for food. Among these are limu lipoa, limu eleele, limu pakaeleawaa, limu mananea, limu lipeepee, limu lipaakai.

FISH MARKETS AND THE HANDLING OF FISHERY PRODUCTS.

There are six fish-market houses on the islands, one each at Honolulu (Oahu), Hilo (Hawaii), and Wailuku (Maui) and three at Lahina (Maui). In addition, peddlers, with small carts and on the backs of jackasses, retail fish throughout the sections of inhabited country which are not convenient to the markets or to the fisheries. There is great room for development in this part of the business, however, as the inhabitants of some of the more inaccessible villages rarely have an opportunity to purchase fresh fish.

HONOLULU.

Previous to 1851 the only market for the sale of fish, vegetables, etc., was an open space in the vicinity of the present location of the Honolulu Iron Works. In 1851 the first regular market house for the

sale of fishery products, etc., was erected on the wharf, and by a law passed May 12 of the same year it was provided that this building and the adjacent grounds seaward of Pulaholaho, belonging to the Government, should be the public market. By a later act, under date of June 25, 1855, the space between the old flour mill and the water, at the west end of Queen street, was reserved for a market.

In 1890 the present market house was erected on the square bounded by Alakea, Richards, Halekauwila, and Allen streets, at a cost, including the value of the land, of $155,000. It is built almost entirely of iron, and is open on all sides except one of the ends, where there are a number of closed booths for the sale of fruit, vegetables, meat, etc., and is one of the best in design and workmanship in the United States. The stalls all have wooden sides with marble tops. There is always plenty of fresh water, while the drainage facilities are of the very best. It is within about 100 yards of the wharf where the Japanese fishermen land, thus making it very convenient for them to bring their catch to the market. The market is owned by the Territorial government, which pays the salaries of the officials in charge of it. The market keeper, who is also the fish inspector, receives a salary of $30 per month as keeper and $60 per month as inspector. There are also an assistant market keeper at $25 per month, an assistant fish inspector at $40 per month, and one laborer at $1.25 per day. All fishery products must be sold in the market house, as hawking through the streets of the city is not permitted. All fish must be inspected before they go upon the stalls, and the market is open every week day and up to 9 a. m. on Sunday.

There are 20 stalls for the sale of fresh fishery products, the rents of which vary from $15 to $30 per month, according to the location. Only 15 of these were occupied in 1900. Of these, 11 were run by Chinese, 3 by Japanese, and 1 by natives, the total number of persons employed, exclusive of the market officials, being Chinese 40, Japanese 6, and natives 2. The usual wage of the help is $12 to $15 per month, including food and lodging. In addition to these, 6 stalls were occupied by 6 native women on Saturday, and sometimes Sunday morning, for the sale of limu (algæ). The charge of these tables is 50 cents on Saturday and 25 cents on Sunday. Three stalls were also devoted to the sale of dried fish from the island of Hawaii during most of the week, and were run by three native women. On a few days in the week when fish are scarce certain of the dealers also sell pickled California salmon, for which they pay an additional license fee of $10 per year.

The fishermen bring their catch to the market at whatever hour is convenient to them, and the dealers sell for them on a basis of 10 per cent commission. Fish brought in prior to noon must be sold before the market closes the same evening, but if brought in after noon they

can, if not sold before night, be kept in a cold-storage house close by at a cost to the owner of 2 cents per pound, and placed on the stalls again the next morning; but in that event they must be distinguished by a small placard bearing the words "Iced fish." The inspector is empowered by law to pass upon all fish before being placed upon the stalls, and can condemn any tainted fish either then or afterwards. It is the usual custom to make frequent inspections of the fish after they go upon the stalls, as they soon taint in the trying climate. No ice is used around the market house, largely owing to its high cost.

The larger fish are dressed, while the smaller ones are sold round. There is no loss in dressing, however, as the head, entrails, etc., are sold. All except gold-fish, and sometimes china-fish, are sold dead.

In addition to the fresh fish sold in 1900, about 72,000 pounds of pickled salmon, with a selling value of $9,000; 9,125 pounds of dried fish, with a selling value of $1,141, and about 18,000 pounds of limu, worth $2,340, were sold in the market.

In wrapping up fish only the leaves of the Ki plant (*Dracæna terminalis*) are used. This leaf is from 10 to 15 inches in length and is oblong in shape. A portion of the stem is left on the leaf when cut. In wrapping, the fish are laid across the narrow part of the leaf, and the end of this is turned tightly over the fish and wound around the stem and then tucked in; the stem of the leaf forms a handle by which to carry the package. The wrapping is done so skillfully that it rarely ever works loose. With the larger packages two or three leaves are used. The Ki plant grows on the mountain side near Honolulu, and is cut and brought to town by natives. The dealers pay about 25 cents for a package of 100 of the leaves.

This is the principal market on the islands and has the largest population tributary to it. Quite complete weekly reports of the fish sold are made to the board of health by the inspector.

The following table shows, by months, the numbers and species of fish sold in the market during 1900:

Table showing by months, numbers, and species the fish sold at the Honolulu market in 1900.

Species.	January.	February.	March.	April.	May.	June.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Aalaihi	1,735	2,156	2,013	4,915	7,390	3,460
Aawa	1,232	1,144	1,961	1,002	683	1,126
Aha			7	155	512	202
Ahi	15			29	32	24
Aholehole	1,900	5,971	9,345	12,998	11,941	4,526
Aku				45	52	521
Akule	267	636	1,570	1,132	5,762	7,967
Amaama	121,054	94,119	93,056	117,027	87,756	56,299
Awa	6,659	6,466	13,527	32,161	19,196	20,125
Awaawa	162	160	296	1,055	1,412	1,399
Awela					8	12
Aweoweo	125	146	137	149	74	79
China-fish	11	15	33	462	36	8
Ea	169	138	121	70	19	61
Gold-fish			172	4,167	2,217	1,552
Hapuupuu	2			46		1

Table showing by months, numbers, and species the fish sold at the Honolulu market in 1900—Continued.

Species.	January.	February.	March.	April.	May.	June.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Hihimanu		4	8		2	
Hilu	123	240	152	179	23	38
Hinalea	3,779	7,563	6,531	7,177	1,991	2,260
Humuhumu	126	924	1,204	2,827	506	976
Iheihe			606	429	74	1,882
Kahala	2		13	42	58	33
Kaku		17	71	159	150	155
Kala	279	1,695	732	380	534	1,248
Kalekale				441	208	12
Kawakawa		11	518	1,844	2,396	2,436
Kumu	622	1,365	939	1,079	688	599
Kupipi	39			16	30	
Kupoupou		20	6	23	6	9
Laenihi	263	493	591	1,990	979	1,127
Lai		5	32	157	157	234
Laipala						2
Lauhau		15	11	39	7	61
Lolohau			1	1		
Mahimahi				10	483	48
Maiii	21			62	11	10
Maikoiko		33	118	39	433	55
Makaa	8	200	19	444	145	89
Malamalama				116		4
Malolo				501	24,325	48,403
Mamamo	10	72	216	72	16	58
Manini	2,125	3,972	4,208	4,559	5,280	2,981
Mano	25	19	12	58	87	202
Maumau	2					
Mikiawa					548	653
Moano	5,291	11,414	11,140	15,952	5,364	5,497
Moi-lii	177	48	453	973	4,037	896
Nanihu	3					
Nenue	4	71	134	134	190	37
Nihipali	42					
Nohu			16	9	6	3
Nunu	39	134	170	743	106	136
Oau				52		1,200
Oio	233	547	685	1,299	2,153	2,472
Olale		19	15		1	
Omakaha				22	2,041	8,964
Omilu	8	40	9	80	95	234
Oopu	2,173	373	474	1,963	660	359
Oopukai	214	321	111			8
Opakapaka				1,486		
Opelu	2,751	4,291	2,727	1,567	733	1,594
Opule		97	123	64	170	22
Pakalakala			87	20	5	
Pakiki		25				
Pakii	178	45	113	232	521	61
Palani	2	2,116	56	104	337	409
Paopao	798	978	2,922	1,305	597	377
Pilikoa		191	30	429	106	560
Poou	38	1,025	6	14		16
Poupou				23	23	7
Pualu	55	556	219	524	843	1,073
Puhi	176	127	224	241	157	200
Uhu	156	242	94	91	45	888
Uku	72	86	68	249	137	666
Ulae		34	46	83	82	210
Ulaula	498	1,772	476	790	615	1,738
Ulua	1,684	1,482	1,552	5,871	3,133	3,415
Umaumalei			124			
Uonoa					25	
Upapalu	1,537	1,259	264	523	637	1,014
Uu	2,739	6,856	3,268	3,490	5,106	3,481
Uwau						133
Wauwau		1				
Weke	1,879	2,282	2,124	5,789	3,043	2,358
Welea		512	30	350	52	505
Haukeuke					50	
Hee	1,437	1,758	1,377	1,844	570	552
Honu		6	4	12	11	23
Muhee	12	54	38	15		
Papai	3,975	9,617	7,494	6,983	4,633	5,053
Ula	781	770	735	1,113	1,852	2,473
Wana	197	143	167	470	401	1,348
Total	167,904	177,341	182,541	257,183	216,320	208,919

Table showing by months, numbers, and species the fish sold at the Honolulu market in 1900—Continued.

Species.	July.	August.	September.	October.	November.	December.	Total for 1900.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Aalaihi	2,610	6,089	5,994	3,272	7,032	11,518	58,184
Aawa	399	354	744	542	211	307	9,705
Aha	154	41	188	209	408	548	2,424
Ahi	128	14	4	2	2		250
Aholehole	4,699	5,499	4,589	5,708	2,044	2,561	71,781
Aku	1,005	1,843	821	484	137	725	5,633
Akule	12,260	38,494	105,689	13,326	18,761	18,169	224,033
Amaama	74,359	52,282	67,112	56,929	79,627	101,951	1,001,571
A'ua'na	294		3	13			261
Awa	24,508	22,364	19,104	21,294	15,691	7,735	208,830
Awaawa	4,199	4,263	1,403	1,058	701	1,479	17,587
Awela	11		12	13	2	2	60
Aweoweo	140	77	114	284	1,319	3,092	5,736
China-fish	8	7	23	19	23	25	670
Ea	2						580
Gold-fish	56	65	1,404	1,634	1,310	795	13,272
Hapuupuu		10	1	18		48	126
Hihimanu	14	2	7	12	3	8	60
Hilu	21	13	40	52	45	6	932
Hinalea	4,356	3,282	4,870	4,596	2,967	4,578	53,950
Humuhumu	1,087	1,064	1,839	793	916	301	12,563
Ihcihe	3,094	1,450	271	3,464	667	4,464	16,401
Kahala	13	6	15	3	8	33	226
Kaku	113	101	120	29	54	31	1,000
Kala	922	580	587	445	459	1,788	9,619
Kalekale			80				741
Kawakawa	3,363	1,331	911	784	378	1,332	15,304
Kole			16		10	52	78
Kumu	1,095	1,335	1,248	908	630	1,111	11,619
Kupipi						2	87
Kupoupou	33	43	51	19	11	4	225
Laenihi	2,514	2,250	2,490	1,403	906	572	15,578
Lai	1,001	176	107	52	112	50	2,083
Laipala							2
Lauhau	9		268	5	1		416
Lolohau							2
Mahimahi	191	60	17	23	26	4	862
Maiii	45		34		196	1,216	1,595
Maikoiko		149	6	27	20	62	942
Makaa	295	203	287	58	74	26	1,848
Malamalama	12	3	15	23			173
Malolo	78,850	57,789	23,960	16,367	8	2,712	252,915
Mamamo	2	107	87	41	273	196	1,153
Manini	2,639	1,117	1,652	1,679	1,514	6,411	38,137
Mano	224	242	431	54	133	46	1,533
Maunau							2
Mikiawa	1,045	150	640	737	127	391	4,291
Moano	8,537	10,226	10,478	8,415	3,709	5,645	101,668
Moi-lii	745	370	509	919	6,510	5,221	20,858
Mu		4	2	14	1	13	34
Nanihu							3
Nenue	74	248	157	44	43	99	1,235
Nihipali							42
Nohu	4	2	11	6	6	15	78
Nunu	196	239	194	703	141	176	2,977
Oau							1,252
Oio	1,807	2,509	1,929	1,606	1,343	1,060	17,643
Olale							35
Omakaha	6,201	1,252	785	2,226	1,444	2,929	25,864
Omilu	87	24	12	285	19	14	907
Ono	1	6	6	1			14
Oopu	405	694	1,657	1,833	2,616	3,099	16,306
Oopukai			22			28	704
Opakapaka							1,486
Opelu	270	809	13,284	12,558	6,483	4,966	52,033
Opule	15	29	60	42	100	299	1,021
Pakalakala							112
Pakiki							25
Pakii	14	40	54	39	2	27	1,326
Palani	194	163	139	108	68	308	4,004
Paopao	1,065	1,395	2,811	1,197	1,743	1,628	16,816
Pilikoa	137	83	52	123	19		1,730
Poou	48	45	44	54	53	22	1,365
Poupou		4					57
Pualu	481	490	520	714	856	824	7,155
Puhi	250	110	208	88	238	96	2,115
Uhu	295	58	44	90	104	298	2,405
Uku	352	144	171	145	133	618	2,841
Ulae	1	10	50	32	1		549
Ulaula	1,342	3,034	2,518	1,753	731	484	15,751
Ulua	3,135	3,184	4,630	3,345	1,223	3,347	36,001

Table showing by months, numbers, and species the fish sold at the Honolulu market in 1900—Continued.

Species.	July.	August.	September.	October.	November.	December.	Total for 1900.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Umaumalei					10	108	242
Uouoa							25
Upapalu	2,571	1,916	3,263	3,133	3,060	6,317	25,494
Uu	6,500	12,312	16,434	13,638	4,263	14,409	92,496
Uwau	109	1	26	64	25	8	366
Weke	2,283	1,949	102,108	11,081	18,680	24,013	177,589
Welea	3	13	3	5	6	14	1,493
Haukeuke							50
Hee	638	490	441	596	480	560	10,743
Honu	71	16	14	2	19	6	184
Muhee				2	2		123
Naia					1		1
Papai	4,871	5,700	4,788	5,638	998	3,065	62,815
Ula	3,645	2,205	2,870	2,429	1,939	1,826	22,638
Wana	1,194	390	730	603	104	331	6,078
Total	273,261	253,019	418,278	209,913	193,979	256,224	2,814,882

The figures on the mollusks, crustaceans, etc., are not complete, but what little was reported has been shown in the table.

The most noticeable feature in this market is the excessively high prices charged for fishery products. As compared with other retail markets of the United States, and possibly of the world, Honolulu ranks first as regards high prices. But few of the better grade of fishes sell for less than 25 cents per pound, some even selling for as high as 35 cents per pound. All fish are sold by number, but they have been reduced to pounds in the general statistical tables, and the prices computed accordingly, so as to conform to data collected in other sections of the United States. Amaama, the commonest species, sells for an average of 25 cents per pound, or $8\frac{1}{3}$ cents each, and ula (crawfish) for 20 cents each or 10 cents per pound. In the *Polynesian*, of Honolulu, under date of September 7, 1844, amaama are quoted at 37 to 50 cents per dozen, other fish 3 to 6 cents per pound, and ula at $6\frac{1}{4}$ cents each. Quite a disparity between the prices of then and now.

There are a number of reasons given to account for this condition of affairs, the principal ones being:

1. Owing to the impossibility of keeping the catch in a fresh condition more than 24 to 48 hours, the fishermen try not to take more than can be easily sold and, because of this, gluts—the principal causes of low prices—rarely occur.

2. Owing to the insufficient transportation facilities there is but little opportunity to bring to one market, where there is a scarcity, the overplus of another. The island of Oahu is much better situated in this regard than any of the others, as there is a railroad which skirts the western and northern shores of the island for nearly one-half of its circumference. This permits of the rapid and cheap transportation of fish from the various places along the railroad to Honolulu, and has been of great assistance in developing the fisheries of these places. But the fishermen on the eastern and southern sides of the island are still com-

pelled to bring their catch to the market in carts and as a result only bring in the higher-priced species, as it would not pay to carry the cheap ones.

3. The fish ponds are principally in the hands of two Chinese firms of Honolulu, and these, by working in harmony and having control of the principal source of supply of the amaama and awa for a considerable part of the year, are enabled to keep up the prices for these species.

4. The Japanese now do the greater part of the line fishing for the Honolulu market, and they have organized a company, including most of the fishermen of that nationality, with the object, among other things, of securing as high prices as possible for their catch.

5. The indiscriminate use of fine-meshed seines has undoubtedly caused a falling off in the catch, although to what extent is a rather difficult problem to solve, owing to the lack of statistical data for previous years.

6. Shortly after the fall of the monarchy a boom began in the islands, especially in Honolulu, and this caused the prices of everything to go up, fish among the others. The price of sugar has largely controlled everything on the islands, and as this has been quite high for some years it has largely affected the prices of other commodities. This boom is on the wane now, and it is probable that matters will settle down to a more normal basis in the course of a few years.

HILO.

The market house at Hilo, which is owned by private parties, was opened for business on April 1, 1899. During 1900 the number of stalls occupied was 27, the rents of which varied from $5 to $15 per month. These were not occupied continuously, as frequently a dealer would give up the business after a week or a month's trial, and someone else would start in. There are 32 stalls in all. The number of persons employed around the market were 22 Chinese, 18 Japanese, and 14 natives. During the summer of 1901 a syndicate of Chinese and Japanese bought up the stalls and began to take advantage of their position by shutting out the other dealers and compelling the fishermen to sell to them at a low price, while there was no limit to what they could charge the townspeople, as fish could not be sold on the streets. As a result, a number of the fishermen carried their catch by carts to Olaa, about 11 miles away, and established a temporary market there.

The Territorial government leased the market in August, 1901, which broke up the combination. An inspector was also appointed, who will have complete charge of everything about the market. Previously there was no inspection, and large quantities of tainted fish were foisted upon the people.

As at Honolulu, every effort is made to dispose of the catch the same day that it comes in, as no ice is used. Owing to the heavy surf close to the market house the fishing boats can not land there, and are compelled to go to Waiakea, a suburb of Hilo, about a mile away. The fishing boats usually land here during the morning and are immediately boarded by the dealers, who begin to dicker for the catch. When a boat with a large catch comes in a stranger would think that bedlam had broken loose, as Japanese, Chinese, Portuguese, Hawaiian, English, and variations of these languages are hurled back and forth, each man trying to outstrip every other in the amount of noise made.

Everything is on a cash basis, the successful dealer counting down the money at once and removing the fish, which are carried to the market by carriers with baskets slung over their shoulders on poles, and by carts. The principal selling time at the market is in the afternoon, after the dealers have returned from Waiakea.

WAILUKU.

The market house at Wailuku is a small affair with only 5 stalls, which are run by 2 Chinese and 5 natives, and is owned by a private individual. The market house, with land, is valued at about $1,500. Most of the fish sold here are brought from Kahului, a few miles away, while some amaama come from the island of Molokai. It has no government supervision, which it needs.

LAHAINA.

The principal market house at Lahaina is owned by the government and is valued at about $6,000, including the land. It contains 6 stalls, which rent at $3 per month. These were run in 1900 by 1 American, 4 Japanese, and 4 natives. Close by are 2 private stalls, which were operated by 4 Japanese. In addition, in 1900, there were 2 private additional fish markets in town, with a total valuation of $650. These contained 6 stalls, which were run by 4 Chinese, 4 Japanese, and 4 natives. The greater portion of one of these was destroyed by fire in the early part of 1901 and has not since been rebuilt.

There is no inspector at Lahaina, although one is very much needed, as the sale of tainted fish, particularly by the Japanese, is quite common. Lahaina is the principal market for the disposal of the fish taken by the fishermen on Molokai and Lanai.

The number of persons employed at these markets has not been shown in the general statistical tables.

THE WHOLESALE TRADE.

The wholesale trade in fishery products is carried on in two cities—Honolulu and Hilo. Owing to the constant demand for such articles from the sugar plantations this business is very profitable. A few of the sugar plantations purchase their supplies direct, and these are not included in the following table. None of the firms is engaged exclusively in this business, being principally wholesale grocery firms.

Honolulu leads in this business in every particular. She had 9 firms employing 73 persons, and a total investment, including wages paid, of $348,380 in 1900, while Hilo had 5 firms, with 30 employees, and a total investment of $161,745, including wages.

Salmon is the principal product handled, followed by sardines, cod, oysters, lobsters, mullets, and shrimp in the order named. The total value of all products handled amounted to $359,965.

Table showing the wholesale trade in fishery products of Hawaiian Islands in 1900.

	Honolulu.		Hilo.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.
Firms	9		5		14	
Employees	73		30		103	
Property		$206,850		$112,000		$318,850
Wages		30,530		12,445		42,975
Cash capital		111,000		37,300		148,300
Total		348,380		161,745		510,125
PRODUCTS						
Albacore, pickled ..... pounds..	21,250	863			21,250	863
Anchovies:						
Spiced (in ½-lb. jars) ..... number..	360	113	48	15	408	128
Spiced (in 2½-lb. kegs) ..... do....	250	1,760			250	1,760
In oils (in ½-lb. jars) ..... do....	240	180			240	180
Barracuda, pickled ..... pounds..	17,300	692	300	12	17,600	704
Bonito, pickled ..... do....	24,650	1,199	13,800	828	38,450	2,027
Cod, dried and pickled:						
Halifax ..... do....	112,000	8,960			112,000	8,960
California ..... do....	465,036	20,142	147,860	6,052	612,896	26,194
Eels, smoked (1-lb. cans) .. number..	120	78			120	78
Finnan haddie (1-lb. cans) ... do....	2,640	715	1,200	225	3,840	940
Herring:						
Fresh (1-lb. cans) ..... do....	1,800	270	2,000	450	3,800	720
Bloaters (1-lb. cans) ..... do....	12,880	2,308	384	64	13,264	2,372
Kippered (1-lb. cans) ..... do....	10,448	2,540	264	61	10,712	2,601
Pickled (100 lbs.) .... half barrels..	180	1,170	35	228	215	1,398
Pickled (15 lbs.) ..... kits..	211	369			211	369
Smoked (4 lbs.) ..... boxes..	175	36			175	36
Smoked (10 lbs.) ..... do....	1,540	538			1,540	538
Mackerel:						
Canned (½-lb.) ..... number..	480	80			480	80
Canned (1-lb.) ..... do....	4,800	800			4,800	800
Canned (2-lb.) ..... do....	2,160	630			2,160	630
Pickled ..... kits..	540	864	163	326	703	1,190
Pickled ..... half barrels..	120	840			120	840
Soused (1-lb. cans) ..... number..	480	63	864	113	1,344	176
Mullet (1-lb. cans) ..... do....	66,480	10,041			66,480	10,041
Salmon:						
Canned (1-lb.) ..... do....	1,213,344	114,151	239,232	22,428	1,452,576	136,579
Canned (2-lb.) ..... do....	4,800	1,000			4,800	1,000
Pickled ..... half barrels..	1,455	8,730	835	5,010	2,290	13,740
Do ..... barrels..	4,793	59,913	173	2,076	4,966	61,989
Do ..... butts..	20	340			20	340
Bellies ..... kits..	522	559	37	71	559	630
Do ..... half barrels..	21	105			21	105
Smoked ..... pounds..	102	12			102	12
Steaks (1-lb. cans) ..... number..	10,224	1,363			10,224	1,363
Sardines (foreign):						
Canned (½ oils) ..... cases..	3,078	27,240	114	848	3,192	28,088
Canned (¼ oils) ..... do....	35	613			35	613
Canned (12 ozs. oils) ..... do....	100	1,175			100	1,175
Canned (¼ tomato) ..... do....	50	475			50	475

Wholesale trade in fishery products of Hawaiian Islands in 1900—Continued.

	Honolulu.		Hilo.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.
PRODUCTS—continued.						
Sardines (American):						
Canned (¼ oils) ..... cases..	759	$3,036	682	$3,069	1,441	$6,105
Shrimp:						
Canned (1-lb.) ..... number..	26,064	2,541	2,736	267	28,800	2,808
Canned (2-lb.) ..... do....	4,848	901	.....	.....	4,848	901
Dried (400 lbs.) ..... barrels..	9	277	99	5,940	108	6,217
Dried (100 lbs.) ..... boxes..	1	18	.....	.....	1	18
Skipjack, pickled ..... pounds..	15,000	600	.....	.....	15,000	600
Sprats, canned (1-lb.) ..... number..	720	270	.....	.....	720	270
Caviar:						
Canned (½-lb.) ..... do....	660	206	276	86	936	292
Canned (¼-lb.) ..... do....	1,224	765	180	113	1,404	878
Clams:						
Canned (1-lb.) ..... do....	35,760	3,427	3,120	325	38,880	3,752
Canned (2-lb.) ..... do....	672	87	.....	.....	672	87
Chowder (3-lb. cans) ..... do....	2,640	462	.....	.....	2,640	462
Juice (1-lb. cans) ..... do....	384	29	.....	.....	384	29
Juice (2-lb. cans) ..... do....	960	100	.....	.....	960	100
Lobsters:						
Canned (½-lb.) ..... do....	19,680	3,034	.....	.....	19,680	3,034
Canned (1-lb.) ..... do....	39,936	8,486	4,416	1,012	44,352	9,498
Oysters:						
Canned (1-lb.) ..... do....	91,440	9,296	35,184	3,482	126,624	12,778
Canned (2-lb.) ..... do....	2,544	604	.....	.....	2,544	604
Curried (½-lb. cans) ..... do....	1,200	350	.....	.....	1,200	350
Curried (1-lb. cans) ..... do....	902	228	.....	.....	902	228
Terrapin stew (1-lb. cans) ..... do....	480	500	.....	.....	480	500
Turtle, green (1-lb. cans) ..... do....	192	35	.....	.....	192	35
Tongues and sounds ..... kits..	.....	.....	9	18	9	18
Total	.....	306,179	.....	53,119	.....	359,965

Fresh fish is also brought to Honolulu from San Francisco in the cold-storage rooms of the regular steamers. Until last year all of this fresh fish came from Victoria in the Canadian steamers, as the San Francisco steamers had no cold-storage rooms previous to that time.

During 1900 the following products (not shown in the wholesale table) were retailed in a fresh state in Honolulu:

	Pounds.		Pounds.
Cod, herring, smelt, and shad	1,323	Salmon trout	312
Flounder	2,270	Sea bass	671
Halibut	35,880	Sole	606
Salmon	27,793	Sturgeon	290

IMPORTS OF FISHERY PRODUCTS.

As the domestic fisheries have not been sufficiently developed to supply the large home demand, great quantities of foreign goods must be imported to make up the deficiency. These imports consist principally of salted, smoked, dried, and canned goods, and are very diverse, owing to the unusual mixture of population. The Chinese and Japanese are the principal consumers of dried abalone, cuttle-fish, oysters, seaweed, and shrimp; the dried and salted cod is preferred by the Portuguese and Porto Ricans, while the natives are great lovers of salmon.

An attempt should be made to introduce the abalone, as it would probably thrive well on the rocky reefs and sea walls.

The raising of sugar is the principal industry of the islands, and as large numbers of laborers are required on the plantations, which are frequently not accessible to markets where fresh fishery products can be obtained, these must be supplied with the prepared products.

The United States have always led in the matter of imports, San Francisco of late years being the principal port from which goods were shipped from the United States to the islands. Previous to the opening of the transcontinental railroads most of the shipments came either by vessel to Colon, thence by rail across the Isthmus of Panama, and by vessel from there to the islands, or by means of vessels which came around the Horn. Many of the whalers which rendezvoused at the islands previous to 1875 also brought out considerable cargoes of general merchandise, including cod, mackerel, and other products of the New England fisheries, which met with a ready sale or barter to the natives and the white people settled on the group.

On January 30, 1875, a reciprocity treaty between the Hawaiian Kingdom and the United States was signed. This treaty went into effect September 1, 1876, and was to continue in force for seven years, and for twelve months after notice of its termination. By its terms in compensation for the free entry to the United States of certain natural products of the islands, notably sugar, the government permitted the free entry, among many other articles, of fishery products of American origin. As the same products from other countries were compelled to pay an ad valorem duty of 10 per cent, this gave the United States an immense advantage. By mutual consent this treaty continued in force until the islands were annexed to the United States on June 14, 1900. The treaty proved of great mutual benefit. For some few years previous to 1876 the sugar industry of the islands had been languishing on account of the duty imposed by the United States on shipments to that country from the islands. As a result of this depressed condition and the consequent inability of the people to buy imported goods, shipments of dried and salted fishery products dropped off until in 1876 they amounted to only $17,891.81. Under reciprocity the imports rapidly increased until in 1899 they amounted to $120,374.83, the greater part of which came from the United States.

The following table shows the value of dried and salted fish imported into the islands from 1865 to June 14, 1900:

Years.	Value of dry and salt fish imported.	Years.	Value of dry and salt fish imported.
1865	$58,224.63	1884	$74,751.85
1866	31,609.04	1885	70,977.04
1867	47,805.61	1886	97,148.12
1868	23,025.69	1887	96,759.83
1869	20,903.08	1888	88,673.17
1870	39,463.15	1889	90,555.23
1871	32,439.51	1890	105,962.91
1872	19,420.60	1891	102,073.65
1873	18,383.52	1892	78,889.93
1874	23,524.30	1893	89,865.02
1875	14,781.74	1894	89,270.24
1876	17,891.81	1895	66,780.80
1877	26,594.82	1896	80,341.34
1878	47,206.95	1897	109,827.68
1879	66,978.33	1898	96,670.23
1880	35,276.72	1899	120,374.83
1881	63,576.95	1900 (to June 14)	59,820.27
1882	65,701.27		
1883	96,630.12	Total	2,268,129.98

The table below shows, by countries, for the years 1897, 1898, 1899, and up to June 14, 1900, the imports of fishery products. This table shows the vast preponderance of the United States over all the other countries combined. A considerable part of the imports from the United States was composed of salmon. Counting complete years, China occupied second place until 1899, when Japan forged to the front. The large influx of Japanese laborers during the past ten years is the principal cause of this considerable increase in Japan's shipments. As the Chinese and Japanese prefer to buy fishery products specially prepared to suit their taste, such as abalone, cuttle-fish, oysters, shrimps, and seaweed, and as these could be obtained only in their home countries, this demand has caused a considerable trade with the countries enumerated. Great Britain is fourth, followed by Canada, Australia and New Zealand, Germany, and France in the order named.

Table showing, by countries, the imports of fishery products during the calendar years 1897, 1898, 1899, and to June 14, 1900.

Countries and products.	1897.		1898.		1899.		1900.*	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Australia and New Zealand:								
Fish, miscellaneous, salted, packages					150	$570		
Herring.....cases..	1	$6						
Mullet, canned.....do....	475	1,883	925		655	2,432	122	$475
Do.....dozen..			400	$3,025				
Total		1,889		3,025		3,002		475
Canada:								
Cod-fish, salted.....pounds..	67,200		40,320		92,200	3,740	72,400	2,850
Do.....drums..	400	3,980	400	3,114				
Fish, fresh.....pounds..	2,800		25,680	1,124			6,141	426
Do.....pieces..	1	102						
Herring.....pounds..	1,900							
Do.....kegs..	55	166	90	172				
Mackerel, salted.....kits..	10							
Do.....barrels..	5	65						
Miscellaneous fish, salted, pounds			2,750					
Miscellaneous fish, salted, packages			65	208				
Salmon, fresh.....pounds..	1,836				13,950	912	27,669	1,468
Do.....boxes..	7		2	1				
Do.....pieces..	2	206						
Salmon, salted..half-barrels..	2							
Do.....barrels..	1	18			2	35		
Total		4,537		4,619		4,687		4,744
China:								
Abalone, dried.....pounds..	5,823		6,379		7,811		1,363	268
Do.....packages..	25	1,228	2	1,224	9	1,710		
Cuttle-fish, dried....pounds..	42,547		52,478		49,278		13,786	
Do.....packages..	46	3,938	25	4,192	70	4,244	2	1,130
Fish, alive.....number..					112	8		
Fish, salted.....pounds..	306,520		300,300		317,527		42,126	
Do.....packages..	285	16,564	190	16,842	324	17,258	49	2,771
Herring.....cases..	4	12						
Oysters, dried.....do....	327	2,669	360	2,591	413	3,417	123	1,162
Seaweed, dried.....package..	44	162	48	138	5			
Do.....cases..					32	209	6	27
Shrimps, dried.....pounds..	2,370							
Do.....packages..	17	101	6	3			9	32
Total		24,674		24,990		26,846		5,390

* As the islands were formally annexed to the United States on June 14, 1900, and no further record was kept of the imports from the United States at the custom-houses, it was thought best to end the records of the other countries at that date, so that they would be uniform.

Table showing, by countries, the imports of fishery products during the calendar years 1897, 1898, 1899, and to June 14, 1900—Continued.

Countries and products.	1897.		1898.		1899.		1900.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
France:								
Sardines, canned ..... cases..	2	$45	1	$5	160	$245	245	.....
Do ..... dozen..	.....	.....	.....	.....	.....	.....	17	$1,907
Total	.....	45	.....	5	.....	245	.....	1,907
Germany:								
Fish, miscellaneous, salted, packages	1	4	.....	.....	.....	.....	.....	.....
Herring ..... kegs..	51	.....	.....	.....	1	4	.....	.....
Do ..... cases..	1	67	.....	.....	.....	.....	.....	.....
Sardines, canned ..... do....	250	966	237	.....	250	784	.....	.....
Do ..... dozen..	.....	.....	1,042	1,244	.....	.....	1,666	638
Total	.....	1,037	.....	1,244	.....	788	.....	638
Great Britain:								
Fish, miscellaneous, salted, pounds	.....	.....	.....	.....	22,400	950	.....	.....
Herring, canned ..... cases..	27	.....	22	.....	1	.....	2	.....
Do ..... dozen..	428	552	666	714	1,111	994	305	.....
Do ..... kegs..	.....	.....	.....	.....	.....	.....	12	251
Mackerel, canned .... dozen..	.....	.....	60	68	96	122	.....	.....
Mullet, canned ..... cases..	55	188	.....	.....	.....	.....	.....	.....
Sardines, canned ..... do....	624	.....	1,057	.....	1,415	.....	133	.....
Do ..... dozen..	2,199	4,973	2,016	6,253	1,917	6,032	1,080	4,131
Sponges ..... pounds..	57	.....	.....	.....	.....	.....	.....	.....
Do ..... cases..	6	365	.....	.....	.....	.....	.....	.....
Do ..... bales..	.....	.....	.....	102	.....	.....	4	327
Total	.....	6,078	.....	7,137	.....	8,098	.....	4,709
Japan:								
Cuttle-fish, dried .... pounds..	5,843	.....	7,756	.....	7,211	.....	510	37
Do ..... packages..	31	547	25	659	47	891	.....	.....
Fish, miscellaneous, salted, pounds	86,454	.....	77,477	.....	191,137	.....	18,215	.....
Fish, miscellaneous, salted, packages	614	6,019	182	5,720	984	16,177	89	1,976
Oysters, dried ..... packages..	17	66	36	119	96	408	8	25
Sardines ..... cases..	565	2,189	1,031	5,093	1,423	8,300	260	1,343
Shrimps, dried ..... pounds..	25	.....	.....	.....	.....	.....	47	5
Do ..... packages..	1	6	4	11	11	45	.....	.....
Seaweed, dried ..... pounds..	1,000	.....	75	.....	6,366	.....	100	.....
Do ..... packages..	917	2,415	1,108	2,717	1,613	5,041	232	594
Total	.....	11,242	.....	14,382	.....	30,862	.....	3,980
United States:								
Abalone, dried ..... pounds..	15,575	.....	16,511	.....	22,404	2,025	8,001	.....
Do ..... packages..	3	1,474	.....	.....	.....	.....	.....	.....
Do ..... barrels..	.....	.....	3	1,461	.....	.....	6	1,069
Barracuda, salted ... pounds..	8,200	.....	6,450	.....	2,600	.....	1,000	.....
Do ..... packages..	1	277	14	326	17	167	5	82
Bonito, salted ..... pounds..	4,500	.....	5,600	.....	2,700	.....	250	.....
Do ..... half-barrels..	93	.....	111	.....	36	.....	.....	.....
Do ..... quarter-barrels..	18	410	8	.....	.....	.....	.....	.....
Do ..... packages..	.....	.....	17	737	4	.....	29	.....
Do ..... barrels..	.....	.....	.....	.....	87	698	19	236
Caviar, canned ..... cases..	36	373	13	.....	.....	.....	12	226
Do ..... boxes..	.....	.....	26	.....	12	.....	.....	.....
Do ..... dozen..	.....	.....	25	592	127	360	.....	.....
Clams, canned ..... cases..	37	.....	58	.....	60	.....	28	.....
Do ..... dozen..	573	1,070	538	1,071	983	1,589	422	789
Cod-fish, salted ..... pounds..	288,218	.....	276,766	.....	267,087	.....	183,690	.....
Do ..... cases..	108	.....	227	.....	210	.....	73	.....
Do ..... bundles..	24	11,272	123	11,257	312	.....	.....	.....
Do ..... kits..	.....	.....	.....	.....	10	.....	.....	.....
Do ..... packages..	.....	.....	.....	.....	.....	.....	1,560	.....
Do ..... barrels..	.....	.....	.....	.....	1	13,007	10	11,559
Herring ..... kegs..	146	.....	163	.....	149	.....	40	.....
Do ..... kits..	12	.....	15	.....	29	.....	20	.....
Do ..... boxes..	811	.....	1,313	.....	1,608	.....	405	.....
Do ..... packages..	194	793	23	.....	266	1,203	132	.....
Do ..... half-pound barrels..	.....	.....	100	1,130	.....	.....	88	708
Lobsters, canned ..... cases..	.....	.....	100	.....	129	.....	124	.....
Do ..... dozen..	1,942	4,103	974	3,078	2,308	6,023	636	3,534
Mackerel ..... kits..	266	.....	318	.....	521	.....	236	.....
Do ..... cases..	23	.....	46	.....	17	.....	100	.....

Table showing, by countries, the imports of fishery products during the calendar years 1897, 1898, 1899, and to June 14, 1900—Continued.

Countries and products.	1897.		1898.		1899.		1900.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
United States—Continued.								
Mackerel.....packages..	30	$802	.....	.....	46	$1,512	17	.....
Do.....barrels..	.....	.....	11	$986	.....	.....	5	$970
Miscellaneous fish, salted, pounds.....	178,674	.....	212,964	.....	165,504	.....	102,709	.....
Miscellaneous fish, salted, half-barrels.....	176	.....	3	.....	18	.....	45	.....
Miscellaneous fish, salted, barrels.....	171	.....	44	.....	4	.....	30	.....
Miscellaneous fish, salted, kits.....	136	.....	.....	.....	7	.....	.....	.....
Miscellaneous fish, salted, packages.....	73	13,857	424	13,467	893	.....	522	.....
Miscellaneous fish, salted, cases.....	.....	.....	.....	.....	10	12,218	18	9,379
Oil, cod-liver .....gallons..	.....	.....	.....	.....	10	14	.....	.....
Oil, sperm .....do...	94	56	1,412	.....	300	.....	251	140
Do .....cases..	.....	.....	6	480	5	.....	.....	.....
Do .....barrels..	.....	.....	.....	.....	3	273	.....	.....
Oil, whale .....gallons..	555	215	291	108	256	138	.....	.....
Oysters, canned.....cases..	470	.....	245	.....	374	.....	731	.....
Do .....dozen..	2,557	.....	3,967	.....	7,427	.....	3,345	8,173
Oysters, fresh .....number..	.....	.....	2,093	.....	5,500	.....	14,300	.....
Do.....packages..	51	.....	94	.....	152	.....	83	.....
Do .....tins..	1,355	6,781	1,423	7,956	3,496	14,935	1,745	1,990
Salmon, canned .....cases..	3,639	.....	4,896	.....	5,240	.....	5,508	.....
Do .....dozen..	18,088	29,937	20,020	32,935	56,757	70,896	18,707	37,413
Salmon, fresh.....pounds..	924	.....	419	.....	6,030	.....	1,193	.....
Do .....number..	.....	.....	.....	.....	33	481	.....	.....
Do.....packages..	3	72	7	41	.....	.....	1	103
Salmon, salted ..half-barrels..	875	.....	538	.....	552	.....	766	.....
Do .....barrels..	4,855	.....	3,813	.....	4,992	.....	3,553	.....
Do .....kits..	290	.....	296	.....	617	.....	402	41,255
Do.....lots..	.....	.....	31	.....	9	43,053	.....	.....
Do .....cases..	51	46,495	6	33,934	.....	.....	.....	.....
Salmon, smoked.....pounds..	485	.....	403	.....	997	.....	163	17
Do .....cans..	.....	.....	3	52	.....	.....	.....	.....
Do.....packages..	16	145	.....	.....	7	105	.....	.....
Sardines, canned .....cases..	261	.....	285	.....	620	.....	705	.....
Do .....dozen..	65	1,881	130	1,684	127	6,922	1	3,297
Seaweed.....packages..	75	469	70	464	64	366	33	306
Shrimps, canned.....cases..	61	.....	17	.....	23	.....	42	.....
Do .....dozen..	224	648	591	989	496	985	448	903
Shrimps, dried .....pounds..	125,451	.....	130,220	.....	135,181	.....	44,118	.....
Do..... .....packages..	59	16,462	64	.....	10	.....	55	.....
Do .....barrels..	.....	.....	49	16,972	53	20,140	2	8,331
Skipjack, salted .....pounds..	9,800	.....	3,000	.....	2,205	.....	1,100	43
Do.....half-barrels..	.....	.....	5	.....	.....	.....	.....	.....
Do.....packages..	14	810	14	.....	67	344	.....	.....
Do.....quarter-barrels..	.....	.....	5	206	.....	.....	.....	.....
Sponges.....number..	.....	.....	4,607	.....	12,241	.....	60	.....
Do.....pounds..	355	.....	286	.....	664	.....	471	.....
Do .....cases..	51	.....	34	.....	.....	.....	.....	.....
Do .....pieces..	1,015	1,241	.....	.....	.....	.....	.....	.....
Do .....boxes..	.....	.....	5	1,514	67	4,371	2	597
Total.....	.....	139,143	.....	131,441	.....	201,825	.....	131,120
Other countries:								
Sardines, canned .....cases..	.....	.....	1	3	.....	.....	.....	.....
Do.....dozen..	417	186	.....	.....	.....	.....	.....	.....
Total.....	.....	186	.....	3	.....	.....	.....	.....

The following table shows, for certain years, the fishery products imported into the islands. Of the ten full calendar years shown, 1899 leads all the others with a value of $276,149. Although the figures for 1900 are for the year up to June 14, they amount to $152,963. As no record of the imports from the United States was kept after annexation on June 14, it was impossible to secure complete figures for the rest of the year. In anticipation of annexation large quanti-

ties of Portuguese and French sardines and New Zealand mullet were imported during the first half of 1900. The tariff in force now on mullet will undoubtedly prevent their importation, as they will be unable to pay the higher duty and compete with the cheaper grades of canned salmon.

Table showing for certain years the imports of foreign fishery products.

Products.	1893.		1894.		1895.		1896.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Abalone, dried ..... pounds..	14,078	.....	17,858	.....	11,741	.....	17,865	.....
Do ..... boxes..	.....	.....	3	.....	.....	.....	.....	.....
Do ..... packages..	32	.....	13	.....	10	.....	11	$2,130
Do ..... sacks..	.....	.....	7	.....	.....	.....	.....	.....
Do ..... barrels..	8	$1,777	3	$2,365	1	$1,435	.....	.....
Albacore, salted ..... ½ barrels..	.....	.....	.....	.....	5	16	.....	.....
Barracuda, salted ..... pounds..	600	.....	4,648	.....	12,185	323	.....	.....
Do ..... packages..	.....	.....	16	.....	.....	.....	5	13
Do ..... ½ barrels..	4	37	10	229	.....	.....	.....	.....
Bonito, salted ..... pounds..	.....	.....	5,850	.....	200	.....	200	.....
Do ..... bales..	.....	.....	41	301	.....	.....	.....	.....
Do ..... ½ barrels..	.....	.....	.....	.....	10	.....	6	.....
Do ..... ⅛ barrels..	.....	.....	.....	.....	39	.....	18	.....
Do ..... barrels..	10	43	.....	.....	15	190	5	103
Caviar, canned ..... cases..	15	.....	14	.....	28	.....	27	.....
Do ..... ½ barrels..	.....	.....	1	.....	.....	.....	.....	.....
Do ..... boxes..	1	.....	.....	.....	.....	.....	.....	.....
Do ..... dozen..	6	154	10	165	6	302	23	146
Clams, canned ..... cases..	14	.....	39	.....	63	.....	65	.....
Do ..... dozen..	393	702	282	671	546	1,082	414	941
Crabs, canned ..... do..	.....	.....	2	8	4	9	.....	.....
Codfish, salted and dried, pounds	283,627	.....	262,877	.....	239,367	.....	304,761	.....
Do ..... cases..	.....	.....	25	.....	138	.....	17	.....
Do ..... bundles..	.....	.....	.....	.....	9	.....	.....	.....
Do ..... bales..	.....	.....	204	.....	.....	.....	.....	.....
Do ..... drums..	.....	.....	.....	.....	.....	.....	100	.....
Do ..... packages..	325	14,162	261	.....	111	.....	76	13,670
Do ..... barrels..	.....	.....	35	14,711	7	10,152	.....	.....
Cuttle-fish, dried ..... pounds..	10,608	.....	21,619	.....	22,482	.....	35,545	.....
Do ..... cases..	.....	.....	2	.....	.....	.....	.....	.....
Do ..... packages..	292	2,705	344	3,357	110	2,402	135	3,961
Fish, sundry, salted ... pounds..	243,285	.....	338,407	.....	236,034	.....	327,356	.....
Do ..... bundles..	.....	.....	.....	.....	11	.....	.....	.....
Do ..... ½ barrels..	258	.....	356	.....	482	.....	253	.....
Do ..... ¼ barrels..	.....	.....	111	.....	242	.....	93	.....
Do ..... barrels..	48	.....	129	.....	4	.....	30	.....
Do ..... casks..	.....	.....	.....	.....	15	.....	.....	.....
Do ..... kits..	.....	.....	.....	.....	.....	.....	51	.....
Do ..... dozen..	.....	.....	1,500	.....	90	.....	.....	.....
Do ..... packages..	919	.....	2,340	.....	1,572	23,936	1,155	.....
Do ..... boxes..	1,396	25,191	.....	.....	.....	.....	.....	.....
Do ..... cases..	.....	.....	13	29,106	.....	.....	10	30,746
Halibut, salted ..... barrels..	.....	.....	15	75	.....	.....	.....	.....
Herring ..... kegs..	115	.....	142	.....	141	.....	107	.....
Do ..... kits..	.....	.....	12	.....	.....	.....	6	.....
Do ..... boxes..	897	.....	568	.....	825	.....	1,097	.....
Do ..... packages..	.....	.....	.....	.....	88	.....	.....	.....
Do ..... ½ barrels..	30	.....	72	.....	.....	.....	55	.....
Do ..... dozen..	211	.....	71	911	561	.....	228	.....
Do ..... barrels..	2	.....	.....	.....	.....	.....	.....	.....
Do ..... cases..	1,019	1,136	33	.....	36	1,342	62	1,067
Lobsters, canned ..... do..	97	.....	85	.....	54	.....	101	.....
Do ..... dozen..	1,396	3,844	294	1,096	862	2,132	1,142	3,129
Mackerel ..... kits..	169	.....	148	.....	220	.....	189	.....
Do ..... pounds..	.....	.....	5	.....	.....	.....	512	.....
Do ..... cases..	141	.....	83	.....	62	.....	29	.....
Do ..... dozen..	28	.....	.....	.....	.....	.....	12	.....
Do ..... packages..	.....	.....	1	.....	.....	.....	.....	.....
Do ..... ½ barrels..	32	.....	82	.....	47	.....	14	.....
Do ..... barrels..	.....	.....	7	.....	1	1,044	13	984
Do ..... kegs..	3	1,256	12	1,315	.....	.....	.....	.....
Mullet, canned ..... cases..	533	.....	658	3,008	440	1,868	695	2,744
Do ..... dozen..	720	3,338	.....	.....	.....	.....	.....	.....
Oil, sperm ..... gallons..	11,141	.....	1,195	.....	1,864	1,076	195	120
Do ..... barrels..	734	15,011	31	1,286	.....	.....	.....	.....
Oil, whale ..... gallons..	706	237	.....	.....	363	117	377	.....
Do ..... barrels..	.....	.....	6	234	.....	.....	4	232
Oysters, canned ..... cases..	159	.....	308	.....	286	.....	265	.....
Do ..... dozen..	2,138	3,965	2,003	3,926	2,614	4,550	2,916	4,908

Table showing for certain years the imports of foreign fishery products.—Continued.

Products.	1893.		1894.		1895.		1896.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Oysters, fresh ..... number..	31,824	.....	2,800	.....	25,000	.....	700	.....
Do ..... sacks..	.....	.....	2	.....	15	.....	.....	.....
Do ..... packages..	29	.....	.....	.....	.....	.....	.....	.....
Do ..... boxes..	.....	.....	37	.....	35	.....	21	.....
Do ..... cans..	1,477	$1,481	1,081	$1,312	1,360	$1,072	1,593	$1,050
Oysters, dried ..... pounds..	1,570	.....	770	.....	.....	.....	.....	.....
Do ..... packages..	231	1,265	186	1,442	225	1,481	272	2,134
Salmon, canned ..... cases..	1,510	.....	2,833	.....	2,273	.....	4,095	.....
Do ..... dozen..	16,827	20,566	9,062	21,282	13,580	23,071	19,504	32,586
Salmon, fresh ..... pounds..	4,794	.....	2,261	.....	2,755	.....	1,806	.....
Do ..... number..	47	589	87	.....	13	.....	5	146
Do ..... kits..	.....	.....	45	502	.....	.....	.....	.....
Do ..... boxes..	.....	.....	.....	.....	2	229	.....	.....
Salmon, salted ..... ½ barrels..	823	.....	775	.....	617	.....	618	.....
Do ..... barrels..	3,451	.....	4,207	.....	3,828	.....	3,737	.....
Do ..... kits..	283	.....	265	.....	429	.....	384	.....
Do ..... tierces..	92	.....	26	.....	14	.....	.....	.....
Do ..... cases..	55	39,662	7	8,525	60	24,218	18	26,429
Salmon, smoked ..... pounds..	1,097	.....	692	.....	825	.....	1,813	.....
Do ..... boxes..	.....	.....	3	98	4	108	9	240
Do ..... cases..	3	140	.....	.....	.....	.....	.....	.....
Sardines, canned ..... do....	489	.....	552	.....	1,343	.....	944	.....
Do ..... dozen..	1,725½	.....	696	.....	406⅔	7,008	1,359	5,296
Do ..... kegs..	2	4,485	38	3,242	.....	.....	.....	.....
Seaweed, dried ..... pounds..	.....	.....	.....	.....	2,982	.....	.....	.....
Do ..... packages..	.....	.....	.....	.....	380	995	903	2,252
Shrimp, canned ..... cases..	1	.....	33	.....	15	.....	19	.....
Do ..... dozen..	210	471	124	444	119	323	274	594
Shrimp, dried ..... pounds..	82,546	.....	67,857	.....	69,740	.....	95,090	.....
Do ..... boxes..	.....	.....	1	.....	.....	.....	.....	.....
Do ..... packages..	45	.....	96	.....	47	.....	31	.....
Do ..... sacks..	.....	.....	2	.....	6	.....	.....	.....
Do ..... barrels..	39	12,203	37	11,312	13	9,169	25	.....
Do ..... cases..	.....	.....	.....	.....	.....	.....	2	11,872
Skipjack, salted ..... pounds..	3,300	.....	1,500	.....	5,800	.....	3,400	.....
Do ..... sacks..	5	.....	.....	.....	.....	.....	.....	.....
Do ..... ½ barrels..	3	.....	.....	.....	.....	.....	27	.....
Do ..... barrels..	71	487	.....	.....	14	194	10	186
Do ..... bales..	.....	.....	46	331	.....	.....	.....	.....
Sponges ..... number..	6	.....	.....	.....	.....	.....	.....	.....
Do ..... dozen..	18	.....	36	.....	32½	.....	55	.....
Do ..... pounds..	1,763	.....	308	.....	96	.....	374	.....
Do ..... cases..	42	.....	36	.....	28	.....	32	.....
Do ..... pieces..	.....	.....	1,796	1,296	1,366	880	2,138	.....
Do ..... bales..	1	1,042	.....	.....	.....	.....	4	1,899
Total	.....	156,239	.....	112,580	.....	120,723	.....	149,578

Products.	1897.		1898.		1899.		1900.*	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Abalone, dried ..... pounds..	21,398	.....	22,920	.....	30,215	.....	9,364	.....
Do ..... packages..	28	$2,702	2	.....	9	$3,734	.....	.....
Do ..... barrels..	.....	.....	3	$2,684	.....	.....	6	$1,337
Barracuda, salted ..... pounds..	8,200	.....	6,450	.....	2,600	.....	1,000	.....
Do ..... packages..	1	277	14	326	17	167	5	82
Bonito, salted ..... pounds..	4,500	.....	5,600	.....	2,700	.....	250	.....
Do ..... ½ barrels..	18	.....	8	.....	.....	.....	.....	.....
Do ..... ⅓ barrels..	93	410	114	.....	36	.....	.....	.....
Do ..... packages..	.....	.....	17	737	4	.....	29	.....
Do ..... barrels..	.....	.....	.....	.....	87	698	19	236
Caviar, canned ..... cases..	36	373	13	.....	.....	.....	12	226
Do ..... boxes..	.....	.....	26	.....	12	.....	.....	.....
Do ..... dozen..	.....	.....	25	592	127	360	.....	.....
Clams, canned ..... cases..	37	.....	58	.....	60	.....	28	.....
Do ..... dozen..	573	1,070	538	1,071	983	1,588	422	789
Cod-fish, salted and dried .. lbs..	355,418	.....	317,086	.....	359,287	.....	256,090	.....
Do ..... cases..	108	.....	227	.....	210	.....	73	.....
Do ..... bundles..	24	.....	123	.....	312	.....	.....	.....
Do ..... drums..	400	15,252	400	14,371	.....	.....	.....	.....
Do ..... kits..	.....	.....	.....	.....	10	.....	.....	.....
Do ..... packages..	.....	.....	.....	.....	.....	.....	1,560	.....
Do ..... barrels..	.....	.....	.....	.....	1	16,747	10	14,409
Cuttle-fish, dried ..... pounds..	48,390	.....	60,234	.....	56,489	.....	14,296	.....
Do ..... packages..	77	4,485	50	4,851	117	5,136	2	1,166
Fish, alive ..... number..	.....	.....	.....	.....	112	8	.....	.....
Fish, sundry, fresh ..... pounds..	2,800	.....	25,680	1,124	.....	.....	6,141	426
Do ..... pieces..	1	102	.....	.....	.....	.....	.....	.....
Fish, sundry, salted .... pounds..	571,648	.....	593,491	.....	696,568	.....	163,050	.....

Table showing for certain years the imports of foreign fishery products—Continued.

Products.	1897.		1898.		1899.		1900.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Fish, sundry, salted ..½ barrels..	176	.....	3	.....	18	.....	45	.....
Do..... barrels..	171	.....	44	.....	4	.....	30	.....
Do..... kits..	136	.....	.....	.....	7	.....	.....	.....
Do.....packages..	973	$36,444	861	$36,236	2,351	.....	660	.....
Do..... cases..	.....	.....	.....	.....	10	$47,072	18	$14,126
Herring..... kegs..	252	.....	253	.....	150	.....	52	.....
Do..... kits..	12	.....	15	.....	29	.....	20	.....
Do..... boxes..	811	.....	1,313	.....	1,608	.....	405	.....
Do.....packages..	194	.....	23	.....	266	.....	132	.....
Do..... ½-pound barrels..	.....	.....	100	.....	.....	.....	88	.....
Do..... dozen..	428	.....	666	.....	1,111	.....	305	.....
Do.....pounds..	1,900	.....	.....	.....	.....	.....	.....	.....
Do..... cases..	33	1,600	22	2,016	1	2,200	2	959
Lobsters, canned.....do....	.....	.....	100	.....	129	.....	124	.....
Do..... dozen..	1,942	4,103	974	3,078	2,308	6,023	636	3,534
Mackerel.....kits..	276	.....	318	.....	521	.....	236	.....
Do.....cases..	23	.....	46	.....	47	.....	100	.....
Do..... dozen..	.....	.....	60	.....	96	.....	.....	.....
Do.....packages..	30	.....	.....	.....	46	1,634	17	.....
Do..... barrels..	5	866	11	1,054	.....	.....	5	970
Mullet, canned.....cases..	530	2,070	925	.....	655	2,432	122	475
Do..... dozen..	.....	.....	400	3,025	.....	.....	.....	.....
Oil, cod-liver..... gallons..	.....	.....	.....	.....	10	14	.....	.....
Oil, sperm..... do....	94	56	1,412	.....	300	.....	251	140
Do..... cases..	.....	.....	6	480	5	.....	.....	.....
Do..... barrels..	.....	.....	.....	.....	3	273	.....	.....
Oil, whale..... gallons..	555	215	291	108	256	138	.....	.....
Oysters, canned.....cases..	470	.....	245	.....	374	.....	731	.....
Do..... dozen..	2,557	.....	3,967	.....	7,427	.....	3,345	8,174
Oysters, fresh..... number..	.....	.....	2,093	.....	5,500	.....	14,300	.....
Do.....packages..	68	.....	94	.....	152	.....	83	.....
Do.....cans..	1,355	6,847	1,423	7,956	3,496	14,935	1,745	1,990
Oysters, dried.....cases..	.....	.....	.....	.....	413	.....	123	.....
Do.....packages..	327	2,669	360	2,740	96	3,825	8	1,187
Salmon, canned.....cases..	3,639	.....	4,896	.....	5,240	.....	5,508	.....
Do..... dozen..	18,088	29,937	20,020	32,935	56,757	70,896	18,707	37,413
Salmon, fresh.....pounds..	2,760	.....	419	.....	19,980	.....	28,862	.....
Do..... number..	.....	.....	.....	.....	33	1,393	.....	.....
Do..... pieces..	2	.....	.....	.....	.....	.....	.....	.....
Do.....packages..	3	.....	7	.....	.....	.....	1	1,571
Do..... boxes..	7	277	2	42	.....	.....	.....	.....
Salmon, salted.....½ barrels..	877	.....	538	.....	552	.....	766	.....
Do..... barrels..	4,856	.....	3,813	.....	4,994	.....	3,553	.....
Do .....kits..	290	.....	296	.....	617	.....	402	41,255
Do.....lots..	.....	.....	31	.....	9	43,088	.....	.....
Do .....cases..	51	46,513	6	33,934	.....	.....	.....	.....
Salmon, smoked.....pounds..	485	.....	403	.....	997	.....	163	17
Do.....cans..	.....	.....	3	52	.....	.....	.....	.....
Do.....packages..	16	145	.....	.....	7	105	.....	.....
Sardines, canned.....cases..	1,702	.....	2,612	.....	3,868	.....	2,290	.....
Do..... dozen..	2,681	10,240	3,188	14,282	2,044	22,183	1,817	11,317
Seaweed, dried.....pounds..	1,000	.....	75	.....	6,366	.....	100	.....
Do..... ....packages..	1,036	3,046	1,226	3,350	1,682	.....	265	.....
Do .....cases..	.....	.....	.....	.....	32	5,615	6	926
Shrimp, canned.....do....	61	.....	17	.....	23	.....	42	.....
Do..... dozen..	224	648	591	989	496	985	448	903
Shrimp, dried..... pounds..	127,846	.....	130,220	.....	135,181	.....	44,165	.....
Do.....packages..	77	16,568	74	.....	21	.....	64	.....
Do..... barrels..	.....	.....	49	16,989	53	20,185	2	8,368
Skipjack, salted..... pounds..	9,800	.....	3,000	.....	2,205	.....	1,100	43
Do..... ¼ barrels..	.....	.....	5	.....	.....	.....	.....	.....
Do..... ⅛ barrels..	.....	.....	5	.....	.....	.....	.....	.....
Do.....packages..	14	310	14	206	67	344	.....	.....
Sponges.....number..	.....	.....	4,607	.....	12,241	.....	60	.....
Do.....pounds..	412	.....	286	.....	664	.....	471	.....
Do..... cases..	57	.....	34	.....	.....	.....	.....	.....
Do.....pieces..	1,015	1,606	.....	.....	.....	.....	.....	.....
Do.....bales..	.....	.....	.....	.....	.....	.....	4	.....
Do..... boxes..	.....	.....	5	1,618	67	4,371	.....	.....
Do.....packages..	.....	.....	.....	.....	.....	.....	2	924
Total.....	.....	188,831	.....	186,846	.....	276,149	.....	152,963

EXPORTS OF FISHERY PRODUCTS.

Owing to the large home demand, the islands have exported but little. The bêche-de-mer and sharks' fins have usually been shipped to China or to the Chinese residents in California, while the gold-fish were sent to California, where they were probably used for ornamental purposes. The exporting was carried on in a small way during the period from 1853 to 1876, in some years nothing being shipped.

The following table shows, by years, the exports of each species:

Years.	Bêche-de-mer.		Sharks' fins.				Gold-fish.		Dried fish.
	Lbs.	Cases.	Lbs.	Cases.	Boxes.	Packages.	No.	Lbs.	Boxes.
1853			100						
1854			200						
1861	6,507								
1862	5,809		50						
1863	5,500		50	14					
1864	7,135								
1865			429						
1867	4,958			1				400	
1868					1		300		
1869		1	6	114			650		
1870					5		500		
1871						4			
1872						3	150		1
1873						4			
1874						4			
1875						3			
1876	1,125								

INTRODUCTION OF ADDITIONAL SPECIES OF FISHES, ETC.

The fresh waters of the Hawaiian Islands are too limited to justify extensive experiments in acclimatization. The streams are necessarily short and during the rainy season they become raging torrents, while in the dry season they are either totally dry or else a series of stagnant pools. The principal streams are on Kauai, Oahu, and Hawaii. The only native fishes in the streams are species of gobies, known collectively as oopu. These have some value as food, but are not highly esteemed. Opai, or shrimp, are also abundant in the streams.

Although the waters in and adjacent to the islands teem with fishes and other denizens of the sea, numerous efforts have been made to introduce additional species. Among the principal species so far introduced are the following:

Black bass.—Black bass would probably thrive in the fresh-water streams, and as the streams are filled with shrimp, there would be an abundant food supply for them. During the summer of 1897 a number of the citizens of Hilo procured a shipment of black bass from the California Fish Commission. In October, 90 of them (about 6 inches in length) were shipped from San Francisco on a Hilo sailing packet, and 55 were living when the vessel arrived. Through some oversight they remained on board several days, 34 of them dying in the mean-

time. The remaining 21 were at last planted in the Wailuke River near Rainbow Falls. The next day there was a heavy freshet in the river, and as the fish were never seen again it is supposed they were too weak to resist, and were swept out to sea and destroyed.

Carp (*Cyprinus carpio*) were introduced some years ago, and are now found on the islands of Maui and Kauai. On the former they are quite common in the irrigation reservoirs and ditches near Wailuku, where they were first planted, but are not often sold, as they are not popular with the white people and natives owing to their muddy flavor. The Japanese and Chinese catch and eat them. On Kauai they are found in irrigation ditches and in a few of the fish ponds. They are sold principally to the Japanese and Chinese.

Cat-fish.—About ten years ago the late Charles Arnold, of Hilo, introduced the cat-fish (*Ameiurus nebulosus*), which he secured from the mainland. They were placed in various ponds in Hilo, but none has ever been seen since. Another species (*Macropternotus maqur*) was introduced from China a few years ago and is now occasionally found in the fresh waters near Honolulu.

China-fish (*Ophiocephalus*).—This species, brought by the Chinese from China, is now fairly common in the vicinity of Honolulu. It is commonly raised in the irrigation ditches and fresh-water ponds and generally sold alive to the Chinese.

Gold-fish (*Carassius auratus*).—These were introduced originally from China, but there is no record as to the date. As early as 1867 shipments of them were being made to San Francisco. They are raised principally in the irrigation ditches around Honolulu. A few are also found on the larger of the other islands, especially near Wailuku, on Maui. They are sold alive in the market and are eaten mainly by the Chinese and Japanese.

Salmon.—In 1876 some salmon and trout eggs were given to parties in Honolulu by the California Fish Commission in exchange for 100 awas, which it designed planting in California waters. There is no record of what became of the eggs.

Trout.—The first introduction of the trout was, as stated above, when the California Fish Commission shipped some eggs to Honolulu parties. In 1894 a consignment of 1,000 brook trout (*Salvelinus fontinalis*) was secured from the California Fish Commission and planted in the Waimea River, on Kauai, but they were soon lost sight of. About 1896 a dozen trout were brought to Hilo and planted in the Wailuke River near Rainbow Falls, but nothing was ever seen or heard of them afterwards. As the streams either dry up entirely in the dry season, or become mere pools, in which the water gets very warm, trout are not suitable for them, as they require pure, cold water.

Frogs.—The date of the introduction of the frog is uncertain, but it is known that some were introduced previous to 1867. In the latter

year a shipment from California was placed in the fresh waters around Honolulu. In the Honolulu Pacific Commercial Advertiser, under date of September 4, 1869, appeared the following item:

Mr. C. P. Ward has imported a few frogs and placed them in a pond at "Sunny South," his country residence at Pawaa [Oahu]. Some years since the agricultural society introduced some, which were placed in taro patches near Dr. Hillebrand's residence, and soon disappeared—supposed to have been killed by the rats.

In October, 1899, a shipment of 6 dozen was landed at Hilo, from Contra Costa County, Cal. They were of two varieties—one dark green and the other mottled. They were brought in a barrel with a little water. The frogs were planted in various places around Hilo, and soon became abundant. In 1900 a few were taken for market. This year (1901) a few were shipped to Honolulu, and it is probable that catching them for market will soon prove remunerative.

They were soon introduced on most of the other islands, and are said to have greatly assisted in the decrease of sickness amongst the numerous herds of cattle, particularly on Kauai, by keeping stagnant pools clean and eating the fluke (*Fasciola hepatica*), a worm which infests the grass and slime in and around the pools. Cattle and sheep eating the grass swallow the fluke, which works its way into the animal's liver, sometimes killing the animal itself. Frogs have also assisted materially in thinning out some of the noxious insects which have been introduced.

Terrapin.—This animal was introduced by the late Charles Arnold, of Hilo, about 1890. Several have been caught since, but nothing has been seen or heard of them during the last few years.

Oysters.—As most of the early white settlers in the islands were from New England and the Middle Atlantic States, they undoubtedly often longed for the delicious oysters of their native States, but very few of them ever expected to enjoy a feast of them unless they should revisit their early haunts. In the course of time the Eastern oyster was transplanted to the Pacific coast, but for a while it was supposed they would not stand transportation so far as Honolulu. However, under date of January 28, 1871, the Pacific Commercial Advertiser, of Honolulu, contained the following article:

A sensation.—We had one this week. We received an invitation to partake of fresh oysters, just out of the shell! They were part of a lot received by the steamer from California, and were they not delicious! We understand they can be delivered here for $7 per bushel. It is proposed, we hear, to plant a bed at Ewa on this island, a good locality having been selected.

It is probable that the attempt at oyster-culture thus mentioned was not carried out, as there is no further mention of it.

On October 28, 1871, there appeared in the Pacific Commercial Advertiser the advertisement of a San Francisco firm offering to furnish transplanted New York oysters in shell at Honolulu during the winter months for $4 a hundred.

In 1883 Mr. Allan Herbert, of Honolulu, purchased 300 Eastern oysters at San Francisco and, bringing them to Honolulu, planted them at Kalihi, but a heavy freshet from the stream covered them up.

In 1893 the matter was taken up by Hon. John F. Colburn, of Honolulu, who writes as follows regarding his experiments:

In the month of October, 1893, I imported from Mr. M. B. Moraghan, of San Francisco, three cases of oysters for the purpose of planting. Two of the cases contained about 1,000 Eastern transplanted, and one case contained about 3,000 of the native California. They were brought down on the steamship *Australia*, in the ice-house, and arrived in apparently good order. I at once had them removed to my pond at Manana Ewa, and planted in a depth ranging from 1 foot to 2 feet of water.

Some three months after I made a thorough search of the different places where I had planted oysters, and found that the native California were all dead, and of the Eastern transplanted about 50 per cent were still living, though considerably sunk into the soft mud at the bottom of the pond. I had these taken up and put down again, and some three months afterwards I examined them again and found they had started to grow; the new shell forming was easily noticeable. I continued my practice of taking them up at different intervals of time until the early part of 1895, when I was so elated with the prospect of my success that I made arrangements with Mr. Moraghan to send me down more Eastern transplanted, with two objects in view: (1) To have fresh Eastern oysters to supply the oyster-eaters of our city, and (2) to have them answer for the purpose of seed for propagating.

I imported 38,614 from San Francisco by the steamship *Australia*, having them come in five different trips of the vessel. About two-thirds were brought down on the open deck in boxes, and were wet down every morning when decks were being washed down. The balance came in the ice-house. With the former way my loss was more in number, but the latter way was the most expensive. On deck I could get the oysters landed for about $10 a ton measurement, but through the ice-house the charges were 5 cents a pound for freight.

As fast as the oysters would arrive I would have them sent down to my pond and laid out. In a month or so afterwards they would get very thin and be unfit for the market. However, I allowed them to recuperate by getting acclimated to the conditions of my pond as well as to the food.

In the latter part of 1895 I discovered young oysters clinging to stones and dead oyster shells. I have watched them very carefully and at different intervals of this year I have found more young ones. Of course the young are not as many as I would like to see, still I trust that in time I will be able to boast of a bed of Hawaiian oysters reared from the seed of the American Eastern oyster. From those I have imported I am in a position to furnish to those desiring oysters a mess of them fresh from the water. The last lot has been now about eighteen months in my pond and are in fine and fat condition, having grown twice their original size.

Fresh sea water empties into my fish pond through gates and a large spring of fresh water also runs into it, thereby making the water a little brackish.*

During the last few years very little attention has been paid to the beds by Mr. Colburn, owing to the pressure of other business, and there are but few oysters left on them now.

This year (1901) there has been considerable agitation of the subject among some of the leading white and native citizens, and it is hoped that the industry will be taken up and established on a paying basis.

*Report on the work of the Steamer Albatross, by Lieut. Com. J. F. Moser, U. S. N. Report of Commissioner of Fish and Fisheries for 1897.

PRIVATE FISHERY RIGHTS.

Probably the most peculiar feature of the Hawaiian fisheries is the well-developed principle of the private ownership of the fishes found in the open sea and bays to within a certain prescribed distance from shore. In order to clearly understand this condition of affairs it will be necessary to revert to the early history of land tenures in the islands.

Although we know practically nothing of the history of the people for some time after they first settled on the islands, it is probable, reasoning from analogy, that they lived in a patriarchal manner, followed later on by a tribal or communal system. In the meantime certain men by force of character and natural talents had become recognized as chiefs, and these men gradually usurped the rights of the common people and in time came to own everything. When a king or chief died his successor claimed the right, and exercised it in most cases, of redistributing the land amongst his own friends and adherents. This continued during the reigns of many petty chiefs and kings until at last all the islands fell under the sway of Kamehameha I, through conquest. The King at once divided the lands among his principal warrior chiefs, retaining, however, a considerable portion for himself. Each chief divided his lands among his inferior chiefs, who subdivided them again and again down to the lowest class of tenants. When Kamehameha II ascended the throne he wanted to redistribute the lands as of old, but matters had rested so long without change during the long reign of Kamehameha I, and the landed interests had become so strong, that he found it impossible to disturb the existing order of things, except in a few instances. Trading in lands now became common, but it was not until 1839 that the ownership of land became vested in others than the King. In the bill of rights which Kamehameha III issued on June 7 of that year occurs the following rather vague paragraph relating to land tenures:

> Protection is hereby secured to the persons of all the people, together with their lands, their building lots, and all their property, while they conform to the laws of the kingdom, and nothing whatever shall be taken from any individual except by express provision of the laws. Whatever chief shall act perseveringly in violation of this declaration shall not longer remain a chief of the Hawaiian Islands, and the same shall be true of the governors, officers, and all land agents. But if anyone who is deposed should change his course and regulate his conduct by law, it shall then be in the power of the chiefs to reinstate him in the place he occupied previous to his being deposed.

It was not, however, until 1848 that land tenure was put upon a solid legal basis by the division of the lands between the King, the chiefs, and the tenants, and vesting the titles in each.

Each island was divided into "moku," or districts. The subdivisions of a "moku" were "ahupuaa," which is really a unit of land in the islands. The "ahupuaas" are generally long, narrow strips, running from the mountain to the sea, and include mountain, the plateau,

the shore, and for a certain distance out to sea. The distance into the sea was to the reef, if there was one; if not, to one geographical mile from shore. The owner of this portion of the sea naturally had the right to control it, so far as the fishing was concerned, the same as he did his land. When he placed a tabu on it branches of the hau tree were planted all along the shore. The people seeing this token of the tabu respected it. With the removal of the hau branches, indicating that the tabu was lifted, the people fished as they desired, subject only to the tabu days of the priest or alii, when no canoes were allowed to go out upon the water.

In accordance with a law which went into effect June 14, 1900, the fishery rights will cease on June 14, 1903. Some of these fishery rights are of considerable value. Close to Honolulu are two fisheries belonging to one person which bring in a yearly rental of $1,375. The fisheries on Oahu are the most valuable, owing to the excellent market for the sale of fish at Honolulu. On Kauai only a few of the fisheries are of sufficient value to be rented, these being mainly around Waimea and Hanalei. One of these rents for $200 a year, while another brings in only $20 per year. A few owners allow the general use of their fisheries to the fishermen, reserving one species for themselves, as they are allowed by law to do.

Practically no effort is made to collect rent for any of the fishery rights of Hawaii. This is largely owing to the sparseness of the population and the consequent lack of markets for the sale of the fish, also somewhat to the disinclination of the people to pay rent. Some years ago the Government leased the Waiakea lands (at Hilo), including the fishing rights, to private parties. The lessees tried to collect rent for the use of the fishery, but without much success, and, as the lease terminated in October, 1899, it became free to everybody, as the new lease exempted the fishing rights.

The principal fishery right on Maui is at Kahului. The rest of them are practically free now. Merely nominal rents are exacted for the use of the fisheries around Molokai. Numerous attempts have been made by the owners to collect rent from the fishermen who frequent the waters around Lanai, but without success.

No effort was made to secure complete data on the value of these fishery rights, as the whole matter would necessarily have to be passed upon by the courts in a short time and the owners did not care to go into the matter fully just now.

For a more complete exposition of the laws concerning private fishery rights, reference is made to the preliminary report of Drs. Jordan and Evermann, pp. 355–380 of this volume. The same paper contains a discussion of the laws regulating the fisheries and of the measures recommended for the further protection and improvement of the industry.

THE FISHERIES CONSIDERED BY ISLANDS.

Commercial fishing is prosecuted on the islands of Oahu, Hawaii, Maui, Molokai, Kauai, Lanai, and Niihau. Fishing is also carried on about some of the smaller islands of the group, but it is done by fishermen from the above-named islands. While the fisheries are of considerable importance now, they could easily be expanded if the proper efforts and attention were given to them. For many years the native Hawaiians held a monopoly of the industry, but of late years the Japanese have been engaging in it in large numbers. The natives fish spasmodically, as a rule, while the Japanese give to it their whole time and attention, and as a result they are doing much better financially than the former. It is probable that the commercial fisheries will be entirely in the hands of the Japanese on certain islands within the next ten years if they increase at the rate they have during the past six or seven years.

At present but little deep-sea fishing is done by the fishermen, although this fishery could be made very profitable. Formerly the natives did all of this fishing, but the Japanese now monopolize it. Some of the best grounds are off the coasts of Molokai, and quite a fleet of Japanese boats from Honolulu resort to them; they usually leave on Monday and return on Friday or Saturday.

At various places around the islands sponges of a fair quality have been picked up on the beaches, where they had been cast up by storms. The writer secured a few specimens which had been washed up on the beach and found them of an inferior grade, but still marketable. These were secured from Oahu and Hawaii. It is probable that but few of the better quality of sponges would be washed ashore, as they would be too firmly attached to the bottom.

The bubonic plague broke out in Honolulu in December, 1899, and lasted several months. This proved a serious detriment to the sale of fresh fishery products while it lasted, as it was thought by many persons that the disease might be transmitted in this way.

The native fishermen have a habit, in many instances, of calling fishes and other sea animals by different names at various stages in their life, also when there is a slight variation in their appearance. In the commercial tables these are generally shown under the name applied to the adult. In order to prevent confusion and misapprehension among the fishermen of the islands and others a list of the commercial species has been prepared, showing the names used in the statistical tables, and where two or more species have been included under one name the others are shown in the list immediately below and are slightly indented. The common English name and the scientific name are also shown where possible. Only a few of the fishes of the Hawaiian Islands are found in the United States, or where there are English-speaking fishermen, hence but few of them have received

English names. In the following list the English names used are, in most instances, generic rather than specific, or such as are applied to all or several of the species of a genus. Many of the identifications are provisional only and may be changed when the collections come to be studied. The list follows:

List of Hawaiian fishes.

Native name.	Common English name.*	Scientific name.
Fishes:		
Aalaihi		Thalassoma duperreyi.
Aawa		Lepidoplois bilunulatus.
Aha		Athlennes (new species).
Ahi	Albacore	Germo sibi.
Ahia		
Aholehole		Kuhlia malo.
Akilolo		Gomphosus and Thalassoma, species.
Aku	Bonito	Gymnosarda pelamis.
Akule	Goggler	Trachurops crumenophthalmus.
Hahalalu		
Alaihi	Squirrel-fish	Holocentrus diadema, etc.
Aloiloi		
Amaama	Mullet	Mugil dobula.
Anae	....do	Mugil dobula (adult).
Anaehole	....do	
Api		Zebrasoma guttatum.
A'ua'u	Mullet	Chænomugil (new species).
Auliuli		
Awa	Milk-fish	Chanos chanos.
Awa kalamoho	.....do	Do.
Awaawa	Big-eyed herring	Elops machnata.
Awela		Thalassoma purpureum.
Aweoweo	Catalufa	Priacanthus cruentatus.
Carp†	Carp	Cyprinus carpio.
China-fish†		Ophiocephalus.
Ea		Lepidoplois modestus.
Goldfish†	Gold-fish	Carassius auratus.
Hapuupuu	Grouper	Epinephelus (new species).
Hauliuli		Lemnisoma thyrsitoides.
Hihimanu	Spotted sting-ray	Aetobatus narinari.
Hilu		Anampses cuvieri.
Hilulauli		Coris lepomis.
Hinalea		Coris, Novaculichthys, etc.
Hinalea lolo		Coris gaimardi.
Humuhumu	Half-beak	
Humuhumu meemee	....do	Hemiramphus depauperatus.
Humuhumu		Melichthys bispinosus, etc.
Iheihe		Euleptorhamphus longirostris.
Ii		
Iiao		
Kahala	Amber-fish	Seriola, species.
Kaku	Barracuda	Sphyræna snodgrassi.
Kala		Monoceros unicornis.
Kawakawa	Bonito	Gymnosarda alleterata.
Kalekale		
Kawelea		
Kikakapu	Butterfly-fish	Chætodon ornatissimus.
Koae		
Koi		Etelis carbunculus.
Kole		
Kuapaa‡		
Kumu	Goat-fish	Upeneus porphyreus.
Ahuluhulu		
Kupipi		
Kupoupou		Cheilio inermis.
Laenihi		Iniistius, Hemipteronotus, etc.
Lai	Mackerel	Scomberoides toto.
Laipala		Zebrasoma flavescens.
Lao		Halichæres lao.
Lauhau	Butterfly-fish	Chætodon quadrimaculatus.
Lauia	Parrot-fish	Scarus jordani, etc.
Lauwiliwili		Forcipiger longirostris.
Laukipala	Mariposa	Lampris luna.
Lolohau	Flying gurnard	Cephalacanthus orientalis.
Loulu	Moorish idol	Zanclus canescens.
Mahihi	Dolphin	Coryphæna hippurus.

*In many instances the common name of a closely related species in the United States is given when the particular species in question is not found here.

†Introduced species.

‡Reputed to be very poisonous.

List of Hawaiian fishes—Continued.

Native name.	Common English name.	Scientific name.
Fishes—Continued.		
Mahimahi	Dolphin	Coryphæna hippurus.
Maiii	Surgeon-fish	Teuthis nigroris.
Maikoiko	....do	Teuthis lineolatus.
Makaa		Malacanthus brevirostris.
Malamalama		
Malolo	Flying-fish	Cypsilurus simus.
Puhikii	....do	Parexoccetus mesogaster.
Mamama	Pintanos	Abudefduf abdominalis.
Mamamo	Rudder-fish	Kyphosus fuscus.
Mamamu		Sphærodon grandoculis.
Maneoneo		Zebrasoma hypselopterum.
Manini	Surgeon-fish	Teuthis sandwichensis.
Mano	Shark	
Heau	....do	
Niuhi	....do	
Mano kihikihi	Hammer-headed shark	Sphyrna zygæna.
Maumau		
Mikiawa		
Moa	Trunk-fish	Ostracion camurum.
Moano	Goat-fish	Upeneus velifer.
Moi-lii		
Moi		Polydactylus sexfilis.
Mu		Sphærodon grandoculis.
Munu	Goat-fish	Upeneus trifasciatus.
Nainai	Surgeon-fish	Teuthis olivaceus.
Nanihu		
Nehu	Anchovy	Anchovia purpurea.
	Silversides	Atherina (new species).
Nenue	Rudder-fish	Hyphosus fuscus.
Nihipali		
Nohu		Scorpænopsis cacopsis.
Nohupinao	Flying-fish	
Nunu	Trumpet-fish	Aulostomus chinensis.
Oau		
Oili	File-fish	Monocanthus spilosomus.
Oililepa	....do	Alutera scripta.
Oio	Bone-fish	Albula vulpes.
Amoomoo	....do	
Okuhekuhe		
Olale		Thalassoma purpureum.
Omaka	Herring	Perkinsia (new species).
Omilu		Carangus melampygus and C. bajad.
Ono	Suck-fish	Remora remora.
Oopu	Goby	Eleotris fusca and Gobies of all species.
Oopuhue*	Puffer	Tetrodon hispidus.
Oopukai		
Poopaa		Paracirrhites cinctus.
Opakapaka		Apsilus kelloggi.
Opelu	Mackerel scad	Decapterus pinnulatus.
Opule		Anampses evermanni, etc.
Paapaa		Cirrhites marmoratus.
Paka		
Pakaikawale		
Pakalakala		
Pakii	Flounder	Platophrys pantherinus.
Pakiki		
Pakole	Surgeon-fish	Teuthis olivaceus.
Pakuikui	....do	Teuthis achilles.
Pala		
Palani	Surgeon-fish	Teuthis matoides.
Palukaluka	Parrot-fish	Scarus paluea.
Panuhunhu	....do	Scarus gilberti.
Paoo		Salarias, species.
Paookauila		
Paopao		
Piha		
Pilikoa		Paracirrhites forsteri, etc.
Poou		Cheilinus hexagonatus.
Poupou		
Puaa humuhumu	Trigger-fish	Balistes rectangulus.
Pua-ii		
Pua kahala	Amber-fish	Seriola purpurascens.
Pualu	Surgeon-fish	Teuthis dussumieri.
Puhei	Moray	Echidna zebra.
Puhi	....do	Gymnothorax (new species).
Puhilaumilo	....do	Gymnothorax undulatus.
Puhiuha	Conger eel	Leptocephalus marginatus.
Puhi wela	Moray	Gymnothorax pectus.
Puwalu		
Puuili		

*Reputed to be poisonous.

List of Hawaiian fishes—Continued.

Native name.	Common English name.	Scientific name.
Fishes—Continued.		
Uhu	Parrot-fish	Calotomus sandwichensis, etc.
Uhuula	....do	Scarus ahula.
Uhikiki		Aprion microdon.
Uiui	Flounder	Platophrys pantherinus.
Uku		Aprion virescens.
Ulae	Lizard-fish	Synodus varius.
Ulaula		Etelis marshi.
Ukikiki		
Ulaula		Apsilus kelloggi.
Ulua		Carangus sausun and other large species of Carangus.
Papiopio		Carangus (species with yellow fins).
Ulua kihi	Thread-fish	Alectis ciliaris.
Umaumalei		
Uouoa		
Upapalu		Apogon menesemus.
Uu	Squirrel-fish	Myripristis murdgan.
Pauu	....do	Myripristis (new species).
Uwau		
Uwiwi	File-fish	Monocanthus spilosomus.
Walu		
Weke	Goat-fish	Upeneus (all species with yellow stripe on sides).
Oamu		
Wekepueo		Upenoides vittatus.
Wekeula	Surmullet	Mulloides pflugeri.
Wekepahulu		Upenoides vittatus.
Welea	Barracuda	
Wolu		
Crustacea:		
Opai	Shrimp	
Papai	Crab	
Aama	....do	
Ula	Crawfish	
Aloalo	....do	
Ulaapapa	....do	
Mollusca:		
Conch	Conch	Purpura aperta.
Haukeuke		
Hee	Octopus	
Hee puloa	....do	
Puloa	....do	
Ina	Sea egg	
Leho	Cowrie	Cypræa carneola, etc.
Muhee	(?) Squid	
Olepa	Clam	Tellina rugosa.
Opihi	Limpet	Neritina granosa.
Pa		Melina costellata.
Pupu	Sea snail	Ricinula horrida.
Wana	Sea egg	
Miscellaneous:		
Frogs	Frogs	
Honu	Turtle	
Limu	Algæ	
Loli	Bêche-de-mer	
Naia	Porpoise	
Ounauna alealea		

Table showing by islands the boats, apparatus, fish ponds, and property used in 1900.

Items.	Hawaii.		Kauai.		Lanai.		Maui.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	198	$16,945	51	$3,215	25	$2,875	80	$7,675
Apparatus:								
Seines	16	780	1	75	21	435	43	1,550
Gill nets	96	2,585	14	103			28	700
Bag nets	4	120	5	820			49	2,103
Cast nets	100	570	16	160			27	270
Dip nets	25	125	28	28			25	63
Scoop nets			10	10			6	6
Lines		568		94		48		124
Spears	67	63	12	12			29	35
Baskets (fish)	30	300					39	390
Baskets (opai)	52	26	6	3				
Snares	8	3						
Fish traps or pens								
Fish ponds	4	1,200	6	5,100				
Shore and accessory property		1,887		1,144		120		2,255
Total		25,172		10,764		3,478		15,171

Items.	Molokai.		Niihau.		Oahu.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	39	$2,950	4	$300	348	$30,980	745	$64,940
Apparatus:								
Seines	9	250			19	1,195	109	4,285
Gill nets	14	134			441	8,871	593	12,398
Bag nets	9	1,250			29	1,955	96	6,248
Cast nets	43	430			83	1,235	269	2,675
Dip nets					68	304	146	520
Scoop nets					69	45	85	61
Lines		78		12		225		1,149
Spears	5	3			51	53	164	166
Baskets (fish)					54	540	123	1,230
Baskets (opai)					47	21	105	50
Snares							8	3
Fish traps or pens					3	1,500	3	1,500
Fish ponds	15	11,425			75	149,050	100	166,775
Shore and accessory property		620		10		4,560		10,596
Total		17,140		322		200,544		272,591

Table showing, by islands and species, the yield of the fisheries in 1900.

Species.	Hawaii.		Kauai.		Lanai.		Maui.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Aalaihi	14,430	$746					6,270	$1,568
Aawa	900	125			180	$54	1,516	439
Aha					110	11	1,697	170
Ahi	27,484	1,280			735	234	1,000	199
Aholehole	1,424	212					3,498	1,049
Aku, fresh	179,492	19,171	10,892	$2,724	38,000	2,111	82,400	7,009
Aku, dried	21,000	840						
Akule, fresh	293,759	33,952	73,614	7,361	33,000	3,300	138,400	13,840
Akule, dried	10,340	620						
Amaama (mullet)	8,593	2,573	60,760	9,115	12,000	4,800	24,000	7,000
A'ua'u	15	1						
Awa	275	26	5,109	511	345	35	1,210	517
Awaawa, fresh	400	39			365	182	2,850	1,225
Awela	1,840	138						
Aweoweo	25	6			200	50	12,590	3,208
Carp			1,500	150				
Hapuupuu	441	27			213	21	2,623	263
Hauliuli, fresh	26,020	2,586			3,800	760	6,100	305
Hauliuli, dried	8,200	656						
Hihimanu	1,462	96			300	15	513	27
Hilu	45	5					7,296	876
Hinalea	1,194	119					12,713	2,543
Humuhumu	14,410	967			1,400	112	6,200	496
Iheihe	8,400	530			5,300	1,590	10,343	3,384
Ii							2,546	256
Iiao	1,500	150			10,625	170	10,700	172
Kahala	40,776	5,907			5,300	824	9,686	1,359

GENERAL STATISTICS.

The three tables below show in a condensed form, by islands, the persons employed and nationality of same, the boats, apparatus, fish ponds, and shore and accessory property used in the business, and the catch by species, together with the value of same.

The island of Oahu leads all the others in almost every phase of the industry, followed by Hawaii, Maui, Kauai, Molokai, Lanai, and Niihau in the order enumerated.

The Hawaiians predominate in the fisheries, followed in the order named by the Japanese, Chinese, South Sea Islanders (people from the Gilbert and Marquesas islands), Americans, Portuguese, and Germans. The total number of persons employed was 2,345. This does not include the persons engaged in the wholesale trade of Honolulu and Hilo, or the persons engaged in the various fish markets, as these have been shown elsewhere.

Oahu leads in the matter of total investment, with $200,544. Hawaii is a poor second, with $25,172 of total investment. The total investment for all the islands was $272,591.

So far as quantity was concerned, the catch of akule leads, but amaama was first in value of catch. Other leading species were malolo, ulua, aku, oio, awa, moano, kawakawa, opelu, opihi, and ula. Oahu leads all the other islands in the quantity and value of catch, followed by Hawaii, Maui, Kauai, Molokai, Lanai, and Niihau, in the order as named. The total catch for all the islands amounted to 6,2 2,455 pounds, valued at $1,083,646.

The malolo catch was confined almost entirely to Oahu, only 3,080 pounds being secured on Hawaii and Molokai. Oau and olepa were taken only in the fisheries of the island of Oahu. Lolohau, nohupinao, okuhekuhe, wolu, frogs, ounauna alealea and pa were taken only on Hawaii, while the carp and puuili catch was confined solely to Kauai. Ii, pakaikawale, puwalu, and loli were taken only on Maui.

A remarkable feature of the fisheries is that but five species—aku, oio, uku, ulaula, and ulua—were taken commercially on all of the islands. It is possible that some of the others are also to be found around all of the islands, but are not sought for commercially.

Table showing, by islands and nationality, the number of persons engaged in the fisheries in 1900.

Nationality.	Hawaii.	Kauai.	Lanai.	Maui.	Molokai.	Niihau.	Oahu.	Total.
Americans	2	3	.....	1	.....	.....	.....	6
Chinese	8	34	.....	3	20	.....	173	238
Hawaiian men	318	104	40	151	103	8	471	1,195
Hawaiian women	87	16	6	80	.....	4	183	376
Japanese	134	50	.....	37	5	.....	259	485
Portuguese	.....	.....	.....	.....	.....	.....	2	2
South Sea Islanders	.....	.....	.....	25	.....	.....	18	43
Total	549	207	46	297	128	12	1,106	2,345

Table showing, by islands and species, the yield of the fisheries in 1900—Continued.

Species.	Hawaii.		Kauai.		Lanai.		Maui.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Kaku	500	$50			125	$13	4,050	$507
Kala	4,399	440			1,300	52	11,809	472
Kalekale	300	30			500	50	1,145	115
Kawelea	1,600	128			700	70	600	60
Kawakawa	47,323	2,837			12,000	1,200	40,300	3,330
Kole	12	1			1,600	400	48,300	9,660
Kuapaa	600	30			1,219	122	3,200	320
Kumu	6,300	588			2,714	1,357	14,400	4,275
Kupoupou	148	15					2,125	850
Laenihi	1,200	118			313	78	3,424	856
Lai	2,522	136					13,266	1,659
Laipala	10	1					3,415	854
Lauhau	3,331	158					2,008	402
Lolohau	50	5						
Mahimahi	9,390	723			1,300	78	2,705	163
Maiii	100	10			460	92	2,887	577
Maikoiko	146	15					4,900	490
Makaa	146	15						
Malamalama	29	3						
Malolo (flying fish)	1,280	112						
Mamamo	50	4					2,129	532
Manini	5,039	382					6,417	1,478
Mano (shark)	2,186	83			961	80	3,600	274
Maumau					82	8	780	78
Mikiawa	275	23					493	49
Moano, fresh	143,460	25,163			5,800	1,450	40,200	10,075
Moano, dried	6,100	305						
Moi-lii	2,000	300	12,400	$2,480	400	20	6,077	303
Mu	25	3			244	61	200	50
Nanihu	10	1			70	7	150	2
Nehu	2,200	220			12,500	200	77,500	1,270
Nenue	400	40			1,200	300	71,200	17,800
Nihipali	12	1						
Nohu	24	2					603	125
Nohupinao	300	30						
Nunu	385	19					1,675	168
Oio	64,509	9,775	51,974	13,017	3,241	810	118,377	29,594
Okuhekuhe	180	18						
Olale	1,177	83					1,960	294
Omakaha	2,100	210						
Omilu	200	20						
Ono	1,888	134			300	90	260	6
Oopu	350	53						
Oopuhue	709	69						
Oopukai	1,139	93					1,192	478
Opakapaka	412	41						
Opelu, fresh	51,396	1,636					41,156	10,289
Opelu, dried	23,100	805						
Opule	32	3			747	149	4,596	615
Paka	400	32					2,062	206
Pakaikawale							1,800	180
Pakalakala	61	5			665	67	542	54
Pakiki	1,745	175			182	18	300	30
Pakii	10,869	560			845	127	11,633	1,745
Palani	5,000	391			1,500	225	8,492	1,274
Paopao							950	95
Piha	945	95			3,500	56	5,585	88
Pilikoa	10	1						
Poou	300	30			200	20	444	111
Poupou	60	6			200	20	260	26
Pua-ii					8,750	143	12,500	200
Pualu	5,595	428			2,182	546	2,065	516
Puhi	19,710	1,386			5,200	1,300	35,519	10,109
Puwalu							4,700	470
Puuili			5,100	153				
Uhu	809	81					875	88
Uku	13,372	928	45,722	25,408	1,800	90	11,715	702
Uiae	714	47			216	43	2,015	403
Ulaula	615	61	26,552	14,341	590	148	800	200
Ulua, fresh	88,675	8,564	88,162	10,016	12,100	3,025	90,725	14,334
Ulua, dried	8,214	246						
Umaumalei	200	20					1,100	110
Uouoa	40	3						
Upapalu	1,524	68			114	11	1,543	154
Uu	34,061	2,136			1,111	167	4,735	908
Uwau	210	17						
Walu					700	70	1,200	300
Weke	1,000	100	11,950	2,820			2,400	360
Welea	600	60			2,854	286	18,412	1,841
Wolu	400	40						
Conchs							700	175
Frogs	380	190						
Haukeuke	10	1						

Table showing, by islands and species, the yield of fisheries in 1900—Continued.

Species.	Hawaii.		Kauai.		Lanai.		Maui.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Hee (octopus)	17,416	$3,031	3,000	$750	2,200	$550	4,198	$1,050
Honu (turtle)	800	64					975	49
Ina (sea eggs)	620	62			300	75	2,870	718
Leho (cowrie)	200	10					1,736	435
Limu (algæ)	2,150	188	397	81	720	180	2,680	268
Loli (bêche-de-mer)							1,158	116
Miscellaneous shellfish							150	23
Muhee (squid)					200	20	3,675	368
Naia (porpoise)	300	30						
Olepa (clam)								
Ounauna alealea	720	72						
Opai (shrimp)	1,118	280	400	200			2,500	625
Opihi (limpet)	16,150	484					1,327	289
Pa	300	30						
Papai (crabs)	800	200	4,567	550	150	38	1,500	375
Pupu (sea snail)							515	52
Ula (crawfish)	15,295	1,758	622	156	6,100	1,525	22,631	5,657
Wana (sea egg)	1,514	151	800	160	600	150	8,880	2,220
Total	1,304,311	137,734	403,521	89,993	212,628	29,853	1,159,117	190,929

Species.	Molokai.		Niihau.		Oahu.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Aalaihi	2,875	$575			3,876	$969	27,451	$3,858
Aawa	1,205	181			5,921	1,481	9,722	2,280
Aha					2,544	283	4,351	464
Ahi	603	60			1,909	241	31,731	2,014
Aholehole	1,834	275			12,612	3,155	19,368	4,691
Aku, fresh	33,300	3,996	380	$95	56,589	6,277	401,053	41,383
Aku, dried							21,000	840
Akule, fresh	33,912	3,391			266,643	19,828	839,328	81,672
Akule, dried							10,340	620
Aloiloi	323	65					323	65
Amaama (mullet)	112,514	28,154			503,794	125,920	721,661	177,562
A'ua'u					24	4	39	5
Awa	2,219	555			233,877	58,139	243,035	59,783
Awaawa, fresh					2,083	522	5,698	1,968
Awaawa, dried			3,100	465			3,100	465
Awelea					26	6	1,866	144
Aweoweo	1,275	446			1,375	590	15,465	4,300
Carp							1,500	150
China-fish					3,988	1,396	3,988	1,396
Ea, fresh					193	48	193	48
Ea, dried			800	120			800	120
Gold-fish					4,854	607	4,854	607
Hapuupuu	502	50			1,890	237	5,669	598
Hauliuli, fresh							35,920	3,651
Hauliuli, dried							8,200	656
Hihimanu					1,790	179	4,065	317
Hilu					995	124	8,336	1,005
Hinalea	1,696	170			3,143	472	18,746	3,304
Humuhumu	7,191	575			14,876	893	44,077	3,043
Iheihe	3,240	810			2,017	404	29,300	6,718
Ii							2,546	256
Iiao							22,825	492
Kahala	2,148	215			3,915	781	61,825	9,086
Kaku					1,067	215	5,742	785
Kala	7,421	594			13,766	688	38,695	2,246
Kalekale							1,945	195
Kawelea							2,900	258
Kawakawa	13,674	1,367			78,135	15,627	191,432	24,361
Koae	643	96					643	96
Kole					6	1	49,918	10,062
Kuapaa							5,019	472
Kumu	11,631	1,744			20,925	5,207	55,970	13,171
Kupoupou	851	213			219	55	3,343	1,133
Kupipi					139	16	139	16
Lacnihi					1,680	421	6,617	1,473
Lai	1,634	163			368	37	17,790	1,995
Laipala							3,425	855
Lauhau	2,065	310			110	11	7,514	881
Lolohau							50	5
Mahimahi	1,895	114			3,344	502	18,634	1,580
Maiii					131	20	3,578	699
Maikoiko	429	43			122	13	5,597	561
Makaa					195	49	341	64
Malamalama					3	1	32	4
Malolo (flying-fish)	800	200			571,002	142,773	573,082	143,085
Mamamo					309	78	2,488	614
Manini	4,067	767			10,005	2,484	25,528	5,111
Mano (shark)	596	30			11,490	219	18,833	686

Table showing, by islands and species, the yield of fisheries in 1900—Continued.

	Molokai.		Niihau.		Oahu.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Maumau							862	$86
Mikiawa	391	$39			842	$211	2,001	322
Moano, fresh	5,497	825			18,042	4,510	212,999	42,023
Moano, dried							6,100	305
Moi-lii					12,642	1,265	33,519	4,368
Mu					32	9	501	123
Nanihu							230	10
Nehu	300	6					92,500	1,696
Nenue					2,260	339	75,060	18,479
Nihipali					42	11	54	12
Nohu	1,006	151			195	47	1,828	325
Nohupinao							300	30
Nunu	2,051	206			1,021	102	5,132	495
Oau					319	80	319	80
Oio	36,000	9,000	7,200	$1,800	40,322	10,080	321,623	74,076
Okuhekuhe							180	18
Olale	1,612	161			11	3	4,760	541
Omakaha					3,627	906	5,727	1,116
Omilu					12,276	1,841	12,476	1,861
Ono	1,171	176			560	56	4,179	462
Oopu					3,843	577	4,193	630
Oopuhue					130	20	839	89
Oopukai	694	139			1,948	486	4,973	1,196
Opakapaka					6,056	606	6,468	647
Opelu, fresh	13,842	2,768			9,361	2,340	115,695	17,033
Opelu, dried							23,100	805
Opule	1,739	174			969	243	8,083	1,214
Paka	1,303	139					3,765	368
Pakaikawale							1,800	180
Pakalakala					10	1	1,278	127
Pakiki							2,227	223
Pakii	4,129	413			4,372	1,530	31,848	4,375
Pala	9,700	1,455					9,700	1,455
Palani	2,540	381			2,604	551	20,136	2,822
Paopao	745	75					1,695	170
Piha							10,030	239
Pilikoa					212	32	222	33
Poou					206	31	1,150	192
Poupou					26	2	546	54
Pua-ii							21,250	340
Pualu					1,876	402	11,718	1,892
Puhi	8,064	968			6,582	658	75,075	14,421
Puwalu							4,700	470
Puuili							5,100	153
Uhu	5,674	567			10,505	2,101	17,863	2,837
Uku	2,617	131	4,400	1,100	14,605	1,459	94,231	29,818
Ulae	616	123			97	10	3,658	626
Ulaula	775	116	1,200	480	11,236	2,809	41,768	18,155
Ulua, fresh	16,692	3,338	4,900	490	324,272	67,630	625,526	107,397
Ulua, dried			5,100	510			13,314	756
Umaumalei					40	4	1,340	134
Uouoa					8	2	48	5
Upapalu	314	31			1,983	297	5,478	561
Uu	1,090	131			33,154	8,288	74,151	11,630
Uwau					185	46	395	63
Walu							1,900	370
Weke	2,878	345	600	120	70,713	17,675	89,541	21,420
Welea	2,422	242			316	64	24,604	2,493
Wolu							400	40
Conchs							700	175
Frogs							380	190
Haukeuke					50	13	60	14
Hee (octopus)	1,700	340			26,085	6,521	54,499	12,242
Honu (turtle)	150	9			2,745	357	4,670	479
Ina (sea eggs)							3,790	855
Leho (cowrie)							1,936	445
Limu (algæ)			145	15	36,672	4,584	42,764	5,316
Loli (bêche-de-mer)							1,158	116
Miscellaneous shellfish							150	23
Muhee (squid)					24	4	3,899	392
Naia (porpoise)					60	2	360	32
Olepa (clam)					327	49	327	49
Ounauna alealea							720	72
Opai (shrimp)					3,694	797	7,712	1,902
Opihi (limpet)			250	65	129,500	19,425	147,227	20,263
Pa							300	30
Papai (crabs)					8,670	2,168	15,687	3,331
Pupu (sea snail)							515	52
Ula (crawfish)			1,200	300	85,334	8,551	131,182	17,947
Wana (sea eggs)			250	63	4,587	1,147	16,631	3,891
Total	376,255	67,599	29,525	5,623	2,737,198	561,915	6,222,455	1,083,646

THE FISHERIES OF HAWAII.

This island is divided into the districts of Hamakua, Hilo, Kau, Kohala, Kona, and Puna. The districts of Kona and Kohala are also frequently subdivided into North and South Kona and North and South Kohala. The only places of importance on the coast are Hilo on the east, Kailua and Napoopoo on the west, and Kawaihae on the northwest. There have been more railroads completed and projected on this island than on any of the others. The Hilo Railroad Company was incorporated March 28, 1899, and so far has completed its railroad from Hilo to Puna plantation, 23 miles. The Olaa branch leaves the main line near Olaa mill and has been located a distance of 17 miles through Olaa toward the volcano of Kilauea. Work on the Kohala Railroad was begun in 1881 and completed in 1882. This road begins at Mahukona and runs along the shore to Niulii, a distance of 20 miles. Although constructed primarily for the benefit of the sugar plantations, the railroads have been of considerable aid to the fisheries, as they have furnished a regular and fairly cheap medium of transportation from the fisheries to the plantations, many of which were inaccessible to the fishermen before.

The Kohala and Hilo Railway Company was incorporated in June, 1899, and when completed will run from Hilo, through the districts of Hilo and Hamakua, to the port of Mahukona, in the Kohala district. This will tap an especially good fishing region, which is but slightly worked at present, owing to the lack of transportation facilities.

In August, 1901, the Kona and Kau Railway Company, limited, was incorporated. This company intends building in the districts of North and South Kona and Kau.

Along the coasts of the Puna and Kau districts sponges are frequently washed up during storms. It is said by persons who have seen them that, while not of as good quality as the Florida sponges, still they are thought to be suitable for some purposes. No attempt has been made as yet to utilize them commercially, although it is possible there would be considerable money in the business could the sponges be properly prepared for market.

The tables which follow (with those already given) show the general features of the fisheries of the island.

The Hawaiians predominate in the fisheries, 405, counting men and women, being employed. Although the Japanese have only engaged in fishing on this island about ten years, they already number 134, and are rapidly increasing from year to year. Only 8 Chinese and 2 Americans were engaged. The total number was 549. The line fisheries employ the largest number of persons, 408, followed by the cast-net fisheries with 105. The seine and spear fisheries employ the same number of persons, 67.

Canoes, rowboats, sampans, and seine boats were the types of boats in use. The most important form of apparatus in use in the fisheries was the gill net. Lines were second so far as value was concerned. Only four fish ponds were used commercially. The total investment for the whole island amounted to $25,172.

Hilo district was the most important fishing section, followed by Kona, Kohala, Hamakua, Puna, and Kau districts in the order named. Akule was the leading species, 304,099 pounds, valued at $34,572, having been secured. Aku, moano, oio, ulua, and hee were the other leading species. The total catch for the island amounted to 1,304,311 pounds, valued at $137,734.

Table showing, by nationality, the number of persons using each form of apparatus in the fisheries of Hawaii in 1900.

Nationality.	Seine.	Gill net.	Bag net.	Cast net.	Dip net.	Line.	Spear.	Snare.	Basket, fish.	Basket, opai.	Fish pond.	Hand.	Total, exclusive of duplication.
Americans	....	1	....	.....	.....	.....	.....	.....	.....	.....	1	.....	2
Chinese	6	....	....	....	.....	.....	.....	.....	.....	.....	8	.....	8
Hawaiian men	41	18	20	78	40	282	67	8	15	.....	2	35	318
Hawaiian women	....	....	....	7	.....	12	.....	.....	.....	52	.....	18	87
Japanese	20	19	....	20	.....	114	.....	.....	.....	.....	.....	.....	134
Total	67	38	20	105	40	408	67	8	15	52	11	53	549

The line fisheries occupy first position, with 998,916 pounds, valued at $110,855, more than two-thirds of the total catch for the whole island. The principal species secured in this fishery were akule, aku, moano, oio, ulua, kahala, and kawakawa.

The seine fisheries were second so far as quantity was concerned, but third in the value of same, the gill-net fisheries being second in value and third in catch. The principal species taken in the seine fisheries were akule, opelu, ulua, and iheihe, and in the gill-net fisheries akule, hauliuli, uu, and ulua.

The cast-net fisheries amounted to 61,531 pounds, valued at $4,292. The principal species were akule, aalaihi, ahia, and pakii.

Opelu alone were taken in the bag-net and dip-net fisheries.

In the basket fisheries manini, puhi, and opai were the principal species obtained.

Hee, kumu, and hihimanu were the leading species secured in the spear fisheries, while ula alone were taken in the snare fisheries.

In the hand fisheries opihi, ula, hee, and papai were the leading species captured.

Table showing, by apparatus and species, the yield of the fisheries of Hawaii in 1900.

Apparatus and species.	Lbs.	Value.
Seines:		
Aalaihi	355	$36
Aawa	700	105
Aholehole	1,200	180
Amaama	3,900	975
Akule	11,400	1,143
Awa	200	20
Awaawa	300	24
Ihiehe	7,300	365
Iiao	1,500	150
Kahala	290	15
Kala	680	68
Kawelea	1,600	128
Kawakawa	2,600	130
Kumu	1,800	138
Laenihi	300	30
Lai	400	20
Malamalama	29	3
Malolo	800	64
Mano	206	4
Mikiawa	275	23
Moano	1,400	140
Nehu	2,200	220
Nunu	385	19
Omakaha	2,100	210
Opelu, fresh	12,623	407
Opelu, dried	7,400	222
Pakiki	1,745	175
Palani	300	12
Piha	945	95
Pualu	800	80
Ulae	417	17
Ulua	4,800	696
Weke	500	25
Total	71,447	5,939
Gill nets:		
Aawa	200	20
Awaawa	100	15
Awa	75	6
Ahi	183	18
Akule	16,109	2,416
A'ua'u	15	1
Awela	800	80
Aweowco	25	6
Hauliuli	7,200	1,080
Hilu	45	5
Humuhumu	1,400	140
Iheihe	1,100	165
Kaku	500	50
Kala	2,900	290
Kole	12	1
Kumu	1,400	140
Laenihi	100	8
Lai	510	51
Laipala	10	1
Lauhau	80	6
Lolohau	50	5
Maiii	100	10
Maikoiko	50	5
Mamamo	20	2
Mano	180	7
Manini	1,300	130
Moi-lii	2,000	300
Mu	25	3
Nanihu	10	1
Nenue	400	40
Nihipali	12	1
Oio	1,400	140
Olale	45	5
Opakapaka	112	11
Opelu	514	51
Pakalakala	61	5
Pakii	20	1
Palani	1,400	140
Pilikoa	10	1
Poou	300	30
Poupou	60	6
Pualu	1,200	120
Uhu	809	81
Ulae	300	30
Ulaula	210	21
Gill nets—Continued.		
Ulua	2,675	$580
Umaumalei	200	20
Uouoa	40	3
Uu	7,900	790
Uwau	210	17
Weke	500	75
Welea	600	60
Haukeuke	10	1
Ula	7,825	939
Total	63,312	8,130
Bag nets:		
Opelu, fresh	13,000	390
Opelu, dried	14,100	423
Total	27,100	813
Cast nets:		
Aalaihi	14,075	710
Ahuluhulu	100	10
Amaama	1,800	900
Ahia	11,579	554
Akule	18,136	1,268
Lauhau	3,251	152
Olale	1,132	78
Oopuhue	609	61
Pakii	10,849	559
Total	61,531	4,292
Dip nets:		
Opelu	22,700	681
Lines:		
Ahi	15,722	708
Aholehole	24	2
Aku, fresh	179,492	19,171
Aku, dried	21,000	840
Akule, fresh	248,114	29,125
Akule, dried	10,340	620
Awela	1,040	58
Hapuupuu	441	27
Hauluili, fresh	18,820	1,506
Hauluili, dried	8,200	656
Hihimanu	290	29
Hinalea	944	94
Humuhumu	13,010	827
Kahala	40,486	5,892
Kalekale	300	30
Kawakawa	44,723	2,707
Kuapaa	600	30
Kupoupou	148	15
Laenihi	800	80
Lai	1,612	65
Mahimahi	9,390	723
Maikoiko	96	10
Makaa	146	15
Malolo	480	48
Manini	2,039	82
Mano	1,800	72
Moano, fresh	142,060	25,023
Moano, dried	6,100	305
Nohu	24	2
Nohupinao	300	30
Oio	63,109	9,635
Omilu	200	20
Ono	1,888	134
Oopuhue	100	8
Oopukai	1,139	93
Opakapaka	300	30
Opelu, fresh	2,499	107
Opelu, dried	1,600	160
Opule	32	3
Paka	400	32
Palani	2,600	169
Pualu	3,295	198
Puhi	17,892	1,113
Ulaula	405	40
Uku	13,372	928
Ulua, fresh	81,200	7,288
Ulua, dried	8,214	246

Table showing, by apparatus and species, the yield of the fisheries of Hawaii in 1900—Continued.

Apparatus and species.	Lbs.	Value.	Apparatus and species.	Lbs.	Value.
Lines—Continued.			Spears—Continued.		
Upapalu	1,524	$68	Palani	500	$50
Uu	26,161	1,346	Pualu	200	20
Wolu	400	40	Puhi	418	63
Hee	3,142	314	Hee	12,674	2,347
Naia	300	30	Honu	800	64
Ounauna alealea	720	72	Ula	100	25
Ula	3,025	303	Total	18,964	2,946
Total	998,916	110,855	Snares:		
Baskets:			Ula	600	60
Hinalea	250	25	Hands:		
Kala	819	82	Hee	1,600	370
Mamamo	30	2	Ina	620	62
Manini	1,700	170	Leho	200	10
Palani	200	20	Limu	2,150	188
Pualu	100	10	Opihi	16,150	484
Puhi	1,400	210	Pa	300	30
Opai	818	205	Papai	800	200
Total	5,317	724	Ula	3,745	431
Spears:			Wana	1,514	151
Hihimanu	1,172	67	Total	27,079	1,926
Kumu	3,100	310			

The fish ponds on Hawaii are of very little importance at present. While there are a number at various places around the island, only four were used commercially. Gill nets alone were used in the fish ponds, and their yield in 1900 was only 1,853 pounds, valued at $416.

Commercial fishing was carried on in but two rivers, the Wailoa and Wailuke, both in the district of Hilo. In the Wailoa River baskets, spears, and lines were employed. The only commercial fishery for frogs on the islands was carried on in this river. This fishery began in 1900, the year under investigation. Lines alone were used in the Wailuke River, amaama being the species sought for.

The following table shows the yield and value of the river fisheries of Hilo in 1900:

Rivers.	Apparatus.	Species	Lbs.	Value.
Wailoa	Baskets	Opai	300	$75
	do	Oopu	350	53
	Spear	Frogs	210	105
	Lines	do	170	85
	do	Amaama	620	130
Wailuke	Lines	do	800	200

KAHOOLAWE.

This is a small island 6 miles west of Maui. The raising of sheep is the only business of the island, 10 persons being employed. These people have a seine which they use in catching a supply of fish for their own consumption. Formerly they sent the surplus to Lahaina whenever an extra large catch was made, but during the past two years they have evidently done but little, as nothing has been received

there from them. There are said to be plenty of fish around the island, but the owner of it claims the fishery right and refuses to allow the fishermen from the other islands to fish there unless they pay him for the privilege.

THE FISHERIES OF KAUAI.

There is little fishing prosecuted from this island, although the adjacent waters are said to teem with fish; but this is largely accounted for by the fact that the efforts of the islanders are devoted almost exclusively to sugar-cane growing, in which more money can be made than in fishing. The writer was informed by numerous white residents that during the greater part of the year it was impossible to purchase fresh fish at any price. Occasionally a few peddlers with horses and small carts make trips through the easily accessible portions of the island with the surplus catch of the fisheries. Those in the vicinity of the fisheries drive to them when they are in operation and thus secure a supply of fish, but as they are operated but a few months of the year, and frequently encounter bad seasons, owing to weather, etc., they can not be counted upon for a steady supply. Kauai is divided into five districts, Hanalei, Kawaihau, Lihue, Koloa, and Waimea. Waimea is the principal town.

The natives predominate in the fisheries, followed by the Japanese, Chinese, and Americans in the order named. The bag-net fisheries employ the greater number of persons with 72, followed by the line fisheries with 64 persons.

Table showing, by nationality, the number of persons using each form of apparatus in the fisheries of Kauai in 1900.

Nationality.	Seine.	Gill net.	Bag net.	Cast net.	Dip net.	Scoop net.	Line.	Spear.	Basket, opai.	Hand.	Total, exclusive of duplication.
Americans	1		1		1						3
Chinese		6	18		10						34
Hawaiian men	8	9	53	4	17	10	26	12			104
Hawaiian women				6						10	16
Japanese				6			38		6		50
Total	9	15	72	16	28	10	64	12	6	10	207

The line fisheries yielded the largest returns of any of the forms of apparatus in use. The principal species taken in this fishery were ulua, uku, oio, and ulaula. The bag-net fisheries occupy second place, the leading species taken in them being akule and amaama. The seine, dip net, scoop net, gill net, spear, and hand fisheries follow in the order enumerated.

Table showing, by apparatus and species, the yield of the fisheries of Kauai in 1900.

Apparatus and species.	Lbs.	Value.	Apparatus and species.	Lbs.	Value.
Seines:			Scoop nets:		
Akule (Hahalalu)	12,414	$1,241	Puuili	5,100	$153
Amaama	5,200	780	Spears:		
Oio	2,900	725	Hee	3,000	750
Ulua	1,800	270			
Total	22,314	3,016	Lines:		
			Aku	10,892	2,724
Bag nets:			Oio	36,061	9,016
Akule (Hahalalu)	61,200	6,120	Uku	45,722	25,408
Amaama	23,510	3,527	Ulaula	26,552	14,341
Oio	13,013	3,276	Ulua	72,529	8,363
Ulua	13,833	1,383	Weke	11,950	2,820
Total	111,556	14,306	Total	203,706	62,672
			Hands:		
Dip nets:			Limu	397	81
Moi-lii	8,300	1,660	Ula	622	156
Papai	4,567	550	Wana	800	160
Total	12,867	2,210	Total	1,819	397
Gill nets:					
Moi-lii	4,100	820			

The products of the pond fisheries are of but little importance, as the ponds were few in number and did not receive much attention. Gill nets were used exclusively in fishing them. A few German carp were captured in them, and these were the only ones taken commercially in the fisheries of the islands. The catch aggregated 28,409 pounds and was valued at $3,931.

The river fisheries of Kauai, like those of the other islands, are insignificant in extent. During 1900 fishing was carried on in the Hanapepe, Waiaula, and Waimea rivers, cast nets and opai baskets being used. Amaama and opai were the only species taken, the aggregate catch being 10,250 pounds of amaama, valued at $1,538, and 400 pounds of opai, worth $200.

THE FISHERIES OF LANAI.

Schools of fishes congregate around the shores of this island, and it is a favorite fishing-ground for the fishermen from Lahaina and the eastern portion of Molokai. Only natives were engaged in the fisheries. Seines and lines were the only forms of apparatus in use, but a number of women and children engaged in fishing with their hands. The total investment in the fisheries of the island was $3,478. The principal species taken in the fisheries were akule, aku, amaama, and ulua. The total catch amounted to 212,628 pounds, valued at $29,853. The portion of the catch not consumed locally is usually carried to the markets at Lahaina, on Maui.

The products of the seine and line fisheries are almost the same, both in quantity and value. In the line fisheries the aku, ulua, kawakawa, and puhi were the leading species, while in the seine fisheries akule, amaama, kumu, and iheihe were most prominent.

Table showing, by apparatus and species, the yield of the fisheries of Lanai in 1900.

Apparatus and species.	Lbs.	Value.	Apparatus and species.	Lbs.	Value.
Seines:			Lines—Continued.		
Ahi	335	$84	Hauliuli	3,800	$760
Akule	33,000	3,300	Hihimanu	300	15
Amaama	12,000	4,800	Humuhumu	1,400	112
Iheihe	4,100	1,230	Iheihe	1,200	360
Iiao	10,625	170	Kahala	5,300	824
Kala	1,300	52	Kaku	125	13
Kalekale	300	30	Kalekale	200	20
Kawelea	918	92	Kawakawa	12,000	1,200
Kole	1,600	400	Mahimahi	1,300	78
Kuapaa	1,219	122	Mano	961	80
Kumu	2,714	1,357	Moano	4,200	1,050
Laenihi	313	78	Oio	3,241	810
Maiii	460	92	Ono	300	90
Maumau	82	8	Pakiki	182	18
Moano	1,600	400	Pakii	845	127
Moi-lii	400	20	Palani	1,500	225
Mu	244	61	Poou	200	20
Nanihu	70	7	Pualu	1,000	250
Nehu	12,500	200	Puhi	5,200	1,300
Nenue	1,200	300	Uku	1,800	90
Opule	747	149	Ulai	216	43
Pakalakala	665	67	Ulaula	590	148
Piha	3,500	56	Ulua	12,100	3,025
Poupou	200	20	Upapalu	114	11
Pua-ii	8,750	140	Uu	1,111	167
Pualu	1,182	296	Walu	700	70
Welea	936	94	Welea	1,700	170
Muhee	200	20			
Total	101,160	13,645	Total	101,398	13,690
Lines:			Hands:		
Aawa	180	54	Hee	2,200	550
Aha	110	11	Ina	300	75
Ahi	400	150	Limu	720	180
Aku	38,000	2,111	Papai	150	38
Awa	345	35	Ula	6,100	1,525
Awaawa	365	182	Wana	600	150
Aweoweo	200	50			
Hapuupuu	213	21	Total	10,070	2,518

THE FISHERIES OF MAUI.

Maui is divided into five districts—Hana, Honuaula, Kaupo, Lahaina, and Wailuku. Kahului, on Kahului Bay, on the north of the neck of land joining the two parts of the island, and Lahaina are shipping ports with fairly safe harbors. The principal port is Lahaina, which was formerly a place of much greater importance than at present, having been the favorite residence of the kings for many years. During the palmy days of the whale fishery Lahaina was a popular port of call for whalers who wanted supplies, as Maui was noted for its potatoes and wheat. At one time the Pacific coast, during the early gold discoveries, drew most of its food supplies of these products from this island. The whalers in time ceased to visit the islands, and as the mainland furnished its own food supplies after a few years, Maui rapidly decreased in wealth and population. Sugar is now the principal crop of the island. Lahaina and Wailuku are the only towns of any size on the island.

A railroad now extends from Wailuku to Kahului, Spreckelsville, and Keia, and this has aided somewhat in extending the opportunities for the marketing of the fishery products taken at the Kahului fishery.

The irrigation dams and ditches on Maui contain numbers of carp and gold-fish, but no commercial use is made of them as yet. The Japanese and Chinese take them in large numbers for home consumption.

The fresh-water streams contain gold-fish, oopu, uwau, and opai, but practically no commercial use is made of these, although large quantities are taken by the natives for home use.

Table showing, by nationality, the number of persons using each form of apparatus in the fisheries of Maui in 1900.

Nationality.	Haul seine.	Gill net.	Bag net.	Cast net.	Dip net.	Scoop net.	Basket.	Line.	Spear.	Hand.	Total, exclusive of duplication.
Americans	1										1
Chinese	3										3
Hawaiian men	49	12	110	3	25	6	8	84	9	3	151
Hawaiian women										80	80
Japanese				24				25			37
South Sea Islanders							25		20		25
Total	53	12	110	27	25	6	33	109	29	83	297

The table below shows by apparatus and species the yield of the fisheries.

The bag-net fisheries were first in importance, with 385,824 pounds, valued at $68,308. Nenue, oio, opelu, kole, moano, and ulua were the principal species taken.

The line catch was second in importance, with 334,387 pounds, valued at $56,481. The leading species taken were oio, aku, puhi, ulua, and moano.

Table showing, by apparatus and species, the yield of the fisheries of Maui in 1900.

Apparatus and species.	Lbs.	Value.	Apparatus and species.	Lbs.	Value.
Seines:			Seines—Continued.		
Ahi	700	$70	Opule	920	$184
Akule	138,400	13,840	Pakalakala	542	54
Amaama	8,000	2,000	Palani	4,400	660
Awaawa	2,050	1,025	Paopao	950	95
Iheihe	5,683	1,705	Piha	5,000	80
Iiao	10,000	160	Poupou	260	26
Kahala	900	144	Pua-ii	12,500	200
Kala	1,200	48	Pualu	800	200
Kalekale	900	90	Ulai	1,600	320
Kawelea	600	60	Ulua	6,100	1,525
Kawakawa	10,000	1,000	Weke	1,100	165
Kole	1,800	360	Welea	3,900	390
Kuapaa	3,200	320	Muhee	500	50
Kumu	11,700	2,925			
Laenihi	300	75	Total	262,183	30,017
Lai	6,300	788			
Maiii	500	100	Gill nets:		
Mano	800	67	Aholehole	800	240
Maumau	180	18	Amaama	16,000	5,000
Mikiawa	493	49	Awa	1,000	500
Moano	1,400	350	Awaawa	600	150
Moi-lii	380	19	Aweoweo	7,000	1,750
Mu	200	50	Kala	1,100	44
Nanihu	150	2	Lai	6,966	871
Nehu	15,000	270	Manini	720	180
Nenue	1,700	425	Moi-lii	3,800	190
Nunu	1,075	108	Nenue	1,800	450

Table showing, by apparatus and species, the yield of the fisheries of Maui in 1900—Cont'd.

Apparatus and species.	Lbs.	Value.
Gill nets—Continued.		
Oio	500	$125
Ulua	8,920	2,230
Welea	6,504	650
Total	55,710	12,380
Bag nets:		
Aalaihi	2,770	693
Aha	1,612	161
Hilu	3,196	384
Hinalea	4,013	803
Iheihe	1,400	700
Ii	2,546	256
Iiao	700	12
Kala	4,709	188
Kole	46,500	9,300
Kumu	2,700	1,350
Kupoupou	1,045	418
Laenihi	3,124	781
Laipala	3,415	854
Lauhau	1,208	242
Maiii	2,387	477
Mamamo	529	132
Manini	1,957	489
Maumau	600	60
Moano	21,000	5,250
Moi-lii	1,897	94
Nehu	62,500	1,000
Nenue	67,700	16,925
Nunu	600	60
Oau	940	109
Oio	41,177	10,294
Opelu	41,156	10,289
Opule	3,675	461
Piha	585	8
Puwalu	4,700	470
Uhu	875	88
Ulua	46,905	4,729
Umaumalei	1,100	110
Upapalu	1,343	134
Uu	3,959	792
Weke	1,300	195
Total	385,824	68,308
Cast nets:		
Aalaihi	3,500	875
Lauhau	800	160
Olale	1,960	294
Pakii	7,933	1,190
Total	14,193	2,519
Scoop nets:		
Kaku	3,900	488
Pakaikawale	1,800	180
Pakii	2,700	405
Total	8,400	1,073
Dip nets:		
Aweoweo	400	100
Maikoiko	4,900	490
Opai	2,500	625
Ula	6,800	1,700
Total	14,600	2,915
Lines:		
Aawa	1,516	439
Aha	85	9
Ahi	300	129
Aholehole	2,698	809
Aku	82,400	7,009
Awa	210	17

Apparatus and species.	Lbs.	Value.
Lines—Continued.		
Awaawa	200	$50
Aweoweo	5,190	1,358
Hapuupuu	2,623	263
Hauliuli	6,100	420
Hihimanu	513	27
Hinalea	2,100	420
Humuhumu	6,200	496
Iheihe	3,260	979
Kahala	8,786	1,215
Kaku	150	19
Kalekale	245	25
Kawakawa	30,300	2,330
Kupoupou	1,080	432
Mahimahi	2,705	163
Mano	1,400	117
Moano	17,800	4,475
Nohu	603	125
Oio	76,700	19,175
Ono	260	6
Oopukai	1,192	478
Paka	2,062	206
Pakii	1,000	150
Pakiki	300	30
Palani	1,892	284
Poou	444	111
Pualu	1,265	316
Puhi	19,319	6,059
Uku	11,715	702
Ulae	415	83
Ulaula	800	200
Ulua	28,800	5,850
Upapalu	200	20
Uu	776	116
Walu	1,200	300
Welea	8,008	801
Muhee	75	8
Papai	1,500	375
Total	334,387	56,481
Baskets:		
Hilu	4,100	492
Hinalea	6,600	1,320
Kala	4,800	192
Mamamo	1,600	400
Manini	2,800	700
Palani	2,200	330
Puhi	14,000	3,500
Total	36,100	6,934
Spears:		
Mano	1,400	90
Puhi	2,200	550
Hee	1,398	350
Honu	975	49
Muhee	3,100	310
Total	9,073	1,349
Hands.		
Conchs	700	175
Hee	2,800	700
Ina	2,870	718
Leho	1,736	435
Limu	2,680	268
Loli	1,158	116
Mollusk	150	23
Opihi	1,327	289
Pupu	515	52
Ula	15,831	3,957
Wana	8,880	2,220
Total	38,647	8,953

THE FISHERIES OF NIIHAU.

This island is devoted almost exclusively to the raising of sheep, and fishing is carried on in a desultory fashion by the employees of the sheep ranch and their families. What they do not consume is carried across the strait to Waimea, on Kauai, and sold there. A small portion of the catch is also dried. Native men and women alone engage in the fisheries. The following table shows by apparatus the yield of the fisheries in 1900:

Species.	Lbs.	Value.
Lines:		
Aku	380	$95
Awaawa, dried	3,100	465
Ea, dried	800	120
Oio	7,200	1,800
Ulaula	1,200	480
Uku	4,400	1,100
Ulua, fresh	4,900	490
Ulua, dried	5,100	510
Weke	600	120
Total	27,680	5,180
Hands:		
Limu	145	15
Opihi	250	65
Ula	1,200	300
Wana	250	63
Total	1,845	443

THE FISHERIES OF MOLOKAI.

Although one of the larger islands of the group, Molokai has but a very small part of the total population. It must have supported a considerable native population at one time, as there are a large number of fish ponds on the southern side of the island, many of which have been abandoned, as, owing to a lack of market consequent upon the rapid dying out of the native population, it did not pay to keep them up. The island at present is used mainly for grazing, as the lack of water makes it unsuitable for the growing of sugar cane. There are no harbors along the coast and no settlements of any size. Pukoo and Kaunakakai, the principal places, are very small villages.

About the center of the northern side of the island, on a point of land extending a considerable distance out into the ocean, are located the two leper settlements, which contain more than half of the total population of the island. Fishing is carried on at these settlements by the lepers—3 bag nets, valued at $450; 10 cast nets, worth $100, and $18 worth of lines, being used. The board of health for the territory, which has charge of the settlements, purchases all the fish that are caught, provided the fishermen care to dispose of them, at a uniform price of 7 cents per pound, and distributes these in lieu of meat ration. Should the fishermen wish to sell personally to the people of the settlements they are permitted to do so. The fishermen are all lepers. This fishing has been included in the tables.

Near Kaunakakai large numbers of clams are found growing in the mud, but are not eaten because of a fine grit found in them.

During 1900 there were 20 Chinese (all in the fish-pond fisheries), 103 natives, and 5 Japanese engaged in the fisheries. The Chinese used gill nets exclusively, the Japanese cast nets, and the natives all forms of apparatus.

The canoe was almost exclusively used in the fisheries, 1 whaleboat alone having been employed. In numbers, the cast net leads all other forms of apparatus. The bag net is the most valuable. There were 15 fish ponds which were worked commercially in 1900, and these were valued at $11,425. The total investment in the fisheries of the island amounted to $17,140.

The amaama is the principal product of the fisheries, 112,514 pounds, valued at $28,154, being taken. Oio is second, with 36,000 pounds, worth $9,000. The total catch for the whole island amounted to 376,255 pounds, valued at $67,599.

Table showing, by apparatus and species, the yield of the fisheries of Molokai in 1900.

Apparatus and species.	Lbs.	Value.
Seines:		
Akule	25,900	$2,590
Amaama	12,200	3,050
Iheihe	495	124
Kahala	428	43
Kawakawa	3,431	343
Kumu	4,282	642
Lai	1,634	163
Mano	596	30
Mikiawa	391	39
Nunu	835	84
Palani	2,540	381
Paopao	745	75
Ulae	616	123
Ulua	6,117	1,223
Weke	1,316	158
Welea	1,272	127
Total	62,798	9,195
Bag nets:		
Akule	7,600	760
Amaama	900	250
Iheihe	1,325	331
Kala	7,421	594
Kumu	7,349	1,102
Malolo	800	200
Manini	3,600	720
Nunu	1,216	122
Oau	467	47
Opelu	13,842	2,768
Opule	1,739	174
Uhu	5,674	567
Weke	1,562	187
Total	53,495	7,822
Spears:		
Puhi	1,200	144
Hee	1,700	340
Honu	150	9
Total	3,050	493
Cast nets:		
Aalaihi	2,875	$575
Amaama	9,714	2,429
Lauhau	2,065	310
Nehu	300	6
Olale	1,612	161
Pakii	4,129	413
Total	20,695	3,894
Line fisheries:		
Aawa	1,205	181
Ahi	603	60
Aholehole	1,834	275
Aku	33,300	3,996
Akule	412	41
Aloiloi	323	65
Aweoweo	1,275	446
Hapuupuu	502	50
Hinalea	1,696	170
Humuhumu	7,191	575
Iheihe	1,420	355
Kahala	1,720	172
Kawakawa	10,243	1,024
Koae	643	96
Kupoupou	851	213
Mahimahi	1,895	114
Maikoiko	429	43
Moano	5,497	825
Nohu	1,006	151
Oio	36,000	9,000
Ono	1,171	176
Oopukai	694	1[illegible]
Paka	1,303	1[illegible]
Palami	9,700	1,[illegible]
Pubi	6,864	[illegible]
Uku	2,617	[illegible]
Ulaula	775	
Ulua	10,575	2,[illegible]
Upapalu	314	
Uu	1,090	
Welea	1,150	[illegible]
Total	144,298	23,215

Amaama and awa were the only species taken in the fish ponds, by far the greater part being of the former. Gill nets took the principal portion, 83,919 pounds, valued at $20,980. Seines were also used, their catch being 8,000 pounds of amaama, worth $2,000.

THE FISHERIES OF OAHU.

This island is divided into 6 districts—Kona (sometimes called Honolulu), Ewa, Waianae, Waialua, Koolauloa, and Koolaupoko.

There is only one line of railway on Oahu, the Oahu Railway and Land Company—which extends from Honolulu to Kahuku, a distance of 71 miles, and which began operations in 1889—but it has proved of almost incalculable benefit to the fisheries of the island. The railway passes close to some of the finest fishing-grounds around the island, and through the excellent business foresight and generous treatment of the management a great impetus has been given to the development of these. During 1900 over 61 tons of fishery products were handled by the railway, most of the shipments being from points within about 35 miles of the city. Fish are usually handled in baskets and boxes holding about 100 pounds each. The rate for carrying the baskets is 25 cents each and for the boxes 30 cents each, which includes also their return to the shipper. In time the company expects to extend its line completely around the island, thus making a belt line.

Canoes, rowboats, sampans, scows, and whaleboats were the styles of boats in general use. The natives and South Sea Islanders used the canoes, the Japanese the sampans, the Chinese the whaleboats, while the other forms were used indiscriminately. More fish ponds were used commercially on this island than on any of the others, there being 75, valued at $149,050. The total investment for the island amounted to $200,544.

Malolo was the principal species taken in the fisheries in both quantity and value, 571,002 pounds, valued at $142,773, having been secured. Amaama was second with 503,794 pounds, worth $125,920, followed by ulua with 324,272 pounds, valued at $67,630. The total for the island was 2,737,198 pounds, valued at $561,915.

Table showing, by nationality, the number of persons using each form of apparatus in the fisheries of Oahu in 1900.

Nationality.	Seine.	Gill net.	Bag net.	Cast net.	Dip net.	Scoop net.	Line.	Spear.	Basket, fish.	Basket, opai.	Fish trap or pen.	Fish pond.	Hand.	Total, exclusive of duplication.
Chinese	36	37	....	....	12	12	....	....	....	....	....	113	....	173
Hawaiian men	5	93	126	81	20	52	101	83	10	2	8	29	30	471
Hawaiian women	....	....	....	....	....	....	....	....	....	35	....	....	148	183
Japanese	24	133	4	12	5	8	159	....	....	....	....	....	....	259
Portuguese	....	....	....	....	....	....	2	....	....	....	....	....	....	2
South Sea Islanders	....	....	15	....	....	....	....	....	18	....	....	....	....	18
Total	65	263	145	93	37	72	262	83	28	37	8	142	178	1,106

In quantity and value of catch bag nets are first with 694,838 pounds, valued at $163,103. Nearly all the malolo are taken in this form of apparatus. The other principal species were weke, akule, and amaama.

Gill nets occupy second place with 619,912 pounds, valued at $104,525. The principal species taken in this form of apparatus were ulua, akule, amaama, awa, and ula.

The catch by lines amounted to 487,954 pounds, which sold for $95,157. Ulua, kawakawa, aku, and oio were the principal species taken in this fishery.

The following tables show, by apparatus and species, the catch by each form of apparatus:

Table showing, by apparatus and species, the yield of the fisheries of Oahu in 1900.

Apparatus and species.	Lbs.	Value.
Seines:		
Aalaihi	1,145	$286
Aawa	2,150	537
Aholehole	4,888	1,222
Amaama	11,058	2,762
Awa	7,274	1,819
Kala	3,385	169
Kumu	2,322	580
Laenihi	1,066	266
Malamalama	3	1
Mikiawa	280	70
Moano	4,555	1,139
Omakaha	3,342	835
Opelu	4,119	1,029
Pakii	2,400	840
Pualu	260	65
Total	48,247	11,620
Gill nets:		
Aawa	3,771	944
Aha	180	30
Aholehole	5,423	1,357
Akule	145,068	10,109
Amaama	105,957	26,464
A'ua'u	24	4
Awa	39,760	9,860
Awaawa	2,083	522
Awela	26	6
Aweoweo	1,375	590
Ea	193	48
Hilu	995	124
Humuhumu	1,000	60
Iheihe	842	169
Kaku	1,067	215
Kala	8,827	441
Kole	6	1
Kumu	5,222	1,306
Kupipi	139	16
Laenihi	103	26
Lai	156	16
Lauhau	12	1
Maiii	131	20
Maikoiko	3	1
Malolo	695	196
Mamamo	2	1
Manini	4,505	1,109
Mano	1,844	30
Mikiawa	562	141
Moano	109	27
Moi-lii	12,642	1,265
Mu	32	9
Nenue	2,260	339
Nihipali	42	11
Nunu	10	1
Oio	19,294	4,823
Omakaha	20	5
Opakapaka	2,000	200
Opelu	2,512	628
Pakalakala	10	1
Palani	9	2
Pilikoa	212	32
Poou	206	31
Poupou	26	2
Pualu	63	15
Puhi	22	2
Uhu	3,892	778
Gill nets—Continued.		
Uku	15	$2
Ulae	6	1
Ulaula	4,096	1,024
Ulua	113,080	20,191
Umaumalei	40	4
Uouoa	8	2
Uu	19,629	4,907
Uwau	185	46
Weke	35,014	8,754
Welea	316	64
Haukeuke	50	13
Honu	120	16
Muhee	24	4
Opai	548	55
Papai	744	186
Ula	72,705	7,278
Total	619,912	104,525
Bag nets:		
Aalaihi	1,239	310
Akule	54,249	4,266
Amaama	14,221	3,555
Iheihe	1,175	235
Kumu	6,163	1,541
Malolo	570,307	142,577
Manini	1,700	425
Mano	3,216	63
Nunu	1,011	101
Oau	319	80
Omakaha	265	66
Opule	258	65
Uhu	6,400	1,280
Upapalu	400	60
Weke	33,915	8,479
Total	694,838	163,103
Cast nets:		
Aalaihi	1,492	373
Ahi	15	2
Akule	66,900	5,410
Kumu	3,118	780
Lauhau	98	10
Olale	11	3
Pakii	1,972	690
Upapalu	983	147
Total	74,589	7,415
Scoop nets:		
Aha	2,364	253
Kumu	2,400	600
Palani	387	58
Pualu	200	50
Ula	2,200	230
Total	7,551	1,191
Dip nets:		
Papai	6,426	1,606
Lines:		
Ahi	1,894	239
Aholehole	2,301	576
Aku	56,589	6,277

Table showing, by apparatus and species, the yield of the fisheries of Oahu in 1900—Cont'd.

Apparatus and species.	Lbs.	Value.
Lines—Continued.		
Hapuupuu	1,890	$237
Hihimanu	1,094	109
Hinalea	1,430	215
Humuhumu	13,876	833
Kahala	3,915	781
Kawakawa	77,135	15,427
Kupoupou	219	55
Laenihi	511	129
Lai	212	21
Mahimahi	3,344	502
Maikoiko	119	12
Makaa	195	49
Mano	5,240	104
Moano	13,378	3,344
Nohu	195	47
Oio	21,028	5,257
Omilu	12,276	1,841
Ono	560	56
Oopukai	1,948	486
Opakapaka	4,056	406
Opelu	2,730	683
Opule	511	128
Palani	19	3
Pualu	396	99
Puhi	2,270	227
Uku	14,590	1,457
Ulae	91	9
Ulaula	7,140	1,785
Ulua	211,192	47,439
Upapalu	600	90
Uu	13,525	3,381
Weke	1,294	319
Hee	10,131	2,532
Naia	60	2
Total	487,954	95,157
Baskets:		
Hinalea	1,713	257
Kala	1,554	78
Kumu	600	150
Mamamo	307	77
Manini	3,800	950
Opule	200	50
Palani	1,789	428
Pualu	657	165
Puhi	2,000	200
Uhu	213	43
Opai	310	78
Total	13,143	2,476
Fish traps or pens:		
Akule	426	43
Kawakawa	1,000	200
Mano	330	5
Weke	490	123
Total	2,246	371
Spears or harpoons:		
Hihimanu	696	70
Kumu	1,100	250
Mano	860	$17
Oopuhue	130	20
Palani	400	60
Pualu	300	8
Puhi	2,290	229
Hee	9,321	2,330
Honu	2,625	341
Ula	400	40
Total	18,122	3,365
Hands:		
Hee	6,633	1,659
Limu	36,672	4,584
Olepa	327	49
Opai	344	86
Opihi	129,500	19,425
Papai	1,500	376
Ula	10,029	1,003
Wana	4,587	1,147
Total	189,592	28,329
Irrigation ditches.		
Hands:		
China-fish	3,770	1,320
Gold-fish	4,000	500
Oopu	325	49
Total	8,095	1,869
Fish ponds.		
Gill nets:		
Amaama	187,362	46,840
Awa	102,192	25,547
Oopu	492	74
Opai	310	31
Total	290,356	72,492
Seines:		
Amaama	36,000	9,000
Awa	13,511	3,128
Total	49,511	12,128
Dip nets:		
Amaana	140,428	35,107
Awa	70,521	17,630
Gold-fish	80	10
Total	211,029	52,747
Scoop nets:		
Amaama	8,768	2,192
Awa	619	155
Total	9,387	2,347
Grand total of fish ponds	560,283	139,714

Formerly there were quite extensive beds of native oysters in Pearl Harbor, but of late years little attention has been given to the gathering of these, and it is not known whether they are to be found in abundance now or not. The mounds of oyster and other shells found at various places around the harbor indicate that oysters were a favorite and common article of food many years ago. For a considerable period they were practically forgotten, until in 1871 Capt. E. Wood, of Honolulu, discovered some beds while surveying around the harbor;

since then natives have gathered them in limited quantities for sale at the Honolulu market. They are said to have a very good flavor.

The yield of the fish ponds was very important on this island owing to their number and size, as shown by the preceding table. The gill net was the most important form of apparatus employed, 290,356 pounds, valued at $72,492, being secured. Dip nets were second, with 211,029 pounds, worth $52,747. The other forms of apparatus took but a limited quantity. Amaama was the principal species secured. The other species were awa, oopu, opai, and gold-fish.

The numerous irrigation ditches for transporting water to the rice fields and taro patches were employed incidentally in raising china-fish, gold-fish, and oopu. The trenches between the rows of Chinese bananas were also used for the same purpose. But a small part of the fish taken in these ditches appears in the table given above, as most of it was consumed by the families of the fishermen or fisherwomen.

Fishing is carried on to a limited extent in nearly all of the fresh-water streams on the island. These streams are few in number, and during a considerable part of the year are almost dry, the rainy season being the only time when they are of any consequence. The only indigenous species in them are the oopu (gobies) and the opai (shrimp). China-fish and gold-fish have been introduced and are taken in limited quantities. A considerable proportion of the catch in these waters was by people living along their banks, and most of it was consumed by the people who caught it. The streams fished commercially were the Kaneohe, Nuuanu, Piinaio, and Waiawa. Scoop nets, dip nets, and baskets were the forms of apparatus in use. The baskets were employed exclusively for opai. Piinaio stream was the most important, followed by Nuuanu, Waiawa, and Kaneohe in the order named. The total catch was 6,200 pounds, valued at $1,174.

Table showing, by rivers and apparatus, the yield of the river fisheries of Oahu in 1900.

Streams.	Apparatus.	Species.	Lbs.	Value.
Kaneohe	Scoop nets	China-fish	104	$36
		Oopu	568	85
Nuuanu	Scoop nets	do	900	135
	Baskets	Opai	750	188
Piinaio	Scoop nets	China-fish	114	40
		Gold-fish	474	59
		Oopu	1,068	160
	Baskets	Opai	1,050	263
Waiawa	Dip nets	Gold-fish	300	38
		Oopu	490	74
	Opai nets	Opai	382	96
Total			6,200	1,174

NOTES OF FORMER FISHERIES OF IMPORTANCE.

At different periods during the past century the islanders have prosecuted certain fisheries with varying success. While some of these proved very successful and were carried on for many years, others soon ceased, owing to the destruction of the object sought, or for other reasons. Among these may be mentioned the whale, seal, otter, shark, pearl, and bêche-de-mer fisheries.

THE HAWAIIAN WHALE FISHERY.

Owing to the immense importance of the foreign fleet, especially the American, which made its headquarters at the islands, the feeble struggles of the domestic fleet are frequently swallowed up and lost sight of in those of its giant competitors. While the files of early Honolulu newspapers contain much which refers to the foreign fleet, there appears but little, and that very fragmentary, on the home fleet. Every effort possible was made to fill in the numerous gaps, but this was found impossible in many instances, and the following can be considered merely as notes on the industry.

VESSEL WHALING.

The first mention of a whaler being fitted out from the islands was in an early number of the *Polynesian*, of Honolulu, which stated that the first whaler fitted out was in 1832, in which H. A. Pierce, of Honolulu, was interested. Later and more thorough inquiries would seem to fix the period at 1834, when the brig *Waverly* was fitted out for whaling and searching among the islands to the westward for Captain Dowsett and others. While engaged in this search she herself was cut off and all her crew massacred at Strong's Island.

In the *Polynesian*, of Honolulu, under date of April 12, 1851, occurs the following:

> We are happy to notice, in connection with the whaling business, that the ship *Chariot* has been purchased in this place by an enterprising company and will soon sail on a whaling voyage under the command of Captain Spencer. We wish them every success, and believe they will meet with it, as Capt. S. is well skilled in the business and has filled ships before. We know of no good reason why this lucrative branch of commerce can not be prosecuted from this port, with many advantages over all others, as we have frequently suggested in the *Polynesian*. It is certainly worthy of the experiment, and we are glad to see it undertaken.

During the fall season of 1852 only one Honolulu vessel was engaged in whaling, the brig *Juno*.

On January 8, 1855, as the ship *Heroine*, owned by R. Coady & Co., of Honolulu, was being towed out of the harbor preparatory to starting on a cruise, the hawser parted and she was wrecked on the reef at the entrance to the harbor.

In the *Friend*, of Honolulu, on March 3, 1858, occurs the following list of vessels owned in and fitted from Honolulu during the spring season of 1858, with the amount of capital invested in each.

List of vessels owned in and fitted from Honolulu in the spring season of 1858.

Flag.	Class and name.	Tons.	Cost, ready for sea.	Remarks.
American	Ship Black Warrior*	231	$10,500	Sperm whaling off coast of California.
Do	Bark Harmony	316	22,000	In port; sails soon for Arctic Ocean.
Do	Bark Italy*	298	19,000	In port; sails soon for Okhotsk.
Do	Bark Vernon	306	23,000	Do.
Do	Bark Metropolis	210	21,000	In port; sails about April 1.
Do	Sch. E. L. Frost	141	13,000	Coast of California.
Hawaiian	Bark Faith	317		Jan. 23 sailed to cruise.
American	Bark Merrimac*	414		Feb. 8 sailed to cruise.
Do	Bark Frances Palmer	303	115,000	On the California coast.
Do	Ship Chas. Phelps	362		Feb. 15 sailed to cruise.
Do	Brig Agate	186		Oct. 14 sailed for California coast.
Hawaiian	Brig Oahu	157	20,000	Dec. 16 sailed to cruise.
Do	Brig Hawaii	230	20,000	Feb. 9 sailed to cruise.
Do	Brig Antilla	220	27,500	In port; sails soon.
Oldenburg	Brig Kauai	220	21,000	Dec. 15 sailed to cruise.
Hawaiian	Brig Victoria	200	23,000	Nov. 30 sailed for California coast.
Do	Brig Wailua	280	24,000	On passage from Bremen; due April 1.
Do	Bark Cynthia	251	19,000	Feb. 13 sailed to cruise.
Do	Bark Gambia	249	17,500	In port; sails soon.

* Each of these vessels had a tender.

In the *Polynesian*, under date of November 20, 1858, occurs the following article:

Hawaiian whalers in port November 19, 1858.

Barks Vernon, Gambia, Silver Cloud, Robert Morrison, Harmony, Frau Henrietta.

Brigs Antilla, Kauai, Hawaii, Wailua, Oahu, Agate. Herm. bg. Pfiel.

Ships Hudson, Adeline, Northern Light, Sharon, Brutus, Sheffield, Ben Morgan, Addison, Majestic.

In the spring fishing 17 left Honolulu for the northern grounds, of which 2 were simply tenders.

Thirteen have arrived, with 6,425 barrels of whale oil, 98,300 pounds bone, besides untold quantity of ivory and peltry obtained by trade. The other two vessels, yet out of port, have been reported with 1,050 barrels between them.

These vessels did not all fly the Hawaiian flag, some being merely owned by residents of the islands and flying the American and Bremen flags. Possibly several of them were really not whalers, but sealers.

At the annual meeting of the Royal Agricultural Society, in 1857, a resolution was passed to award "a silver cup to the master, silver medals to the officers, and bronze medals to the crew of the whaling vessel, fitted out from these islands, which shall bring in the largest cargo of oil next year in proportion to her size." Although their attention was called to this matter the latter part of 1858, the society failed to live up to its promise.

In 1859 the fleet was composed of the following vessels:

Rig.	Name.	Tons.	Rig.	Name.	Tons.
Schooner	Alice	106	Brig	Kohola	270
Brig	Aloha	294	Do	Oahu	164
Do	Antilla	239	Schooner	Pfiel	106
Bark	Cynthia	251	Brigantine	Victoria	200
Do	Faith	317	Brig	Wailua	264
Do	Harmony	316	Schooner	Caroline, tender to Faith	106
Brig	Hawaii	230			

The American bark *Florence*, 326 tons, and Oldenburg brig *Kauai*, 220 tons, were also owned and fitted out in Honolulu.

One of the new vessels to start in the business about 1860 was the schooner *Kalama*, of 85 tons. This vessel was built at Waterford, Conn., in 1846. She arrived at the islands in 1857 under the name *Queen of the West*, when "Capt. John Meek purchased her and named her after the dowager Queen Kalama, relict of Kamehameha III, and placed her in the coasting trade July 14, 1857, on the windward route. A short time afterwards J. I. Dowsett bought her and put her in the whaling service under command of L. Kelly. In the winter of 1861 she made a very successful season in company with the brig *Comet*, returning here April 11, 1862, reporting 1,200 barrels. She was then sold and subsequently used as coaster, royal yacht, guano searcher, sperm whaler, and again as coaster."*

On April 1, 1865, the Hawaiian vessels *Pearl* and *Harvest* were lying at Ascension in company with a number of American whalers, when the Confederate steamer *Shenandoah* destroyed the whole fleet, the Hawaiian vessels being burned so that they could not warn other vessels. Their owners were reimbursed by the American Government from the money paid by Great Britain as a result of the Alabama Claims Commission award.

In 1867 the fleet comprised the following vessels: Schooner *Pfiel*, brig *Kohola*, bark *Eagle*, bark *Oregon*, bark *Hae Hawaii*, brig *Comet*. Three more were added to the fleet late in the year, the schooners *Wm. H. Allen* and *Emeline* and the bark *Julian*, but they did no whaling in 1867. Some of the Bremen whalers were also owned in Honolulu at this period.

In 1868 the schooner *Wm. H. Allen* sperm-whaled among the Bonin Islands and got 300 barrels of sperm oil. In 1870 she visited the coast of Peru, where she got 220 barrels of sperm oil. Sperm-whaling at this time was rather unusual among the whalers frequenting the islands, as most of them were engaged in right and humpback whaling in the North Pacific and the Arctic oceans. The *Wm. H. Allen* dropped out of the business in 1872.

In 1869 the fleet comprised the following vessels:

Rig.	Name.	Tons.
Brig	Kohola	270
Bark	Arctic	425
Bark	Lono	207
Bark	Eagle	382
Brigantine	Wm. H. Allen	157
Bark	Count Bismarck	453
Bark	Wilhelm I	463
Brig	Comet	255
Ship	Julian	362
Bark	Paiea	386

In 1871 a terrible disaster happened to the whaling fleet in the Arctic Ocean by which 34 vessels were abandoned in the ice. Among these

*Hawaiian Maritime History, Part II. Hawaiian Almanac and Annual for 1891, pp. 130, 131.

were the following Hawaiian vessels: Bark *Comet*, bark *Paira Kohola*, bark *Victoria 2d*, ship *Julian*. Early in the year the *Eagle* and *Count Bismarck* had been withdrawn from the whaling fleet and thus escaped the fate of the others. This disaster almost wiped out the home fleet.

In 1876 the only Hawaiian vessels in the Arctic, the bark *Arctic*, valued at $32,000, and the *Desmond*, valued at $24,000, were abandoned in the ice. Eleven American vessels were abandoned at the same time.

After 1881, when there were 2 vessels in the business, there is practically no mention of Hawaiian whalers until 1894, when the last vessel, the steamer *Alexander*, 294 tons, gave up the business under the Hawaiian flag and is now in the San Francisco fleet.

After 1875 very few foreign whalers called at the islands, as it was found more profitable to refit and transship oil and bone from San Francisco, owing to the railroad connection with the Eastern seaboard, and as most of the Hawaiian whalers were owned by Americans they were transferred to San Francisco with the rest of the fleet or else withdrawn from the business.

The following table shows the Hawaiian fleet and the catch of same for certain years from 1839 to 1894, both inclusive:

Year.	Vessels.		Sperm oil.		Whale oil.		Whalebone.		Ivory.		Walrus teeth.		Fur skins.	Total value.
	No.	Tonnage.	Gals.	Val.	Gals.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Val.	
1839	1													
1840	1													
1842	2													
1851	1													
1852	1				1,440		400							$567
1854	2													
1856														87,280
1857	4		6,297	$6,297	148,671	$59,468	64,915	$16,229			22,863	$2,286		84,280
1858	17													
1859	14	4,112												
1860	6	1,595												57,033
1861	4	880												55,350
1862	3	734												33,164
1863	2	622												25,771
1864	5	1,500												93,729
1865	5	1,356												78,830
1866	4	1,168												91,329
1867	6	1,636												59,922
1868	9	2,570												40,557
1869	10	3,360												175,873
1870	12													140,918
1871	7													12,240
1872	4													39,818
1873	5		1,600	1,520	34,541	12,018	17,787	13,161	4,262	$903			90	
1874			7,304	6,941	50,968	17,413	21,492	16,564	11,569	3,015			730	44,663
1875			30	29	102,856	37,531	38,854	35,883	21,553	9,970			330	
1876							13,057	12,494	8,042	3,217				
1878	1	189												
1880	1	188												
1881	2	103												
1894	1	294												

NOTE.—The fact that nothing is noted for certain years does not necessarily indicate that there were no vessels during those years, but rather the lack of data.

The following table shows the exports from the islands of products taken by the Hawaiian whaling fleet from 1857 to 1880, both inclusive. A small proportion of the catch would be consumed locally and this, of course, does not appear in the table.

Table showing exports from the Hawaiian Islands of products taken by the Hawaiian whaling fleet from 1857 to 1880.

Year.	Sperm oil.	Whale oil.	Whalebone.	Seal oil.	Ivory.	Walrus hides.
	Galls.	*Galls.*	*Lbs.*	*Galls.*	*Lbs.*	*Pieces.*
1857	.....	53,332	21,997	.....	.....	.....
1858	.....	86,959	39,300	.....	.....	.....
1859	.....	219,187	60,480	7,254	.....	.....
1861	6,794	188,548	27,003	.....	.....	.....
1862	9,988	11,392	2,716	.....	.....	.....
1863	3,096	137,855	37,872	.....	.....	.....
1864	8,360	123,023	45,402	.....	.....	.....
1865	2,280	111,421	33,716	.....	.....	.....
1866	44,968	46,218	56,840	.....	.....	.....
1867	58	70,646	48,444	.....	1,702	.....
1868	15,007	41,585	11,960	.....	.....	.....
1869	8,971	153,735	89,842	.....	1,116	.....
1870	3,654	134,167	101,101	.....	12,718	152
1871	4,867	140,319	283	.....	582	450
1872	98	23,083	23,336	.....	3,804	.....
1873	3,795	42,306	17,561	.....	.....	.....
1874	621	48,605	16,174	.....	10,979	.....
1875	597	81,375	41,955	.....	20,814	.....
1876	.....	33,518	23,965	.....	.....	.....
1877	805	186	11,507	.....	.....	.....
1878	.....	7,254	14,865	.....	.....	.....
1879	.....	.....	816	.....	.....	.....
1880	.....	14,662	10,977	.....	.....	.....

BAY WHALING.

In addition to the vessel fishery for whales a number of persons engaged at various times in what was called "bay whaling." The small humpback whales in the winter time would resort to the region between Lahaina and Kalepolepo Bay for breeding purposes. The sperm whales would also do the same to the leeward side and off the southern point of Hawaii, and also off the other islands at times. When a whale was sighted close to the shore parties would go out in small boats and attempt to capture it. If successful, the whale would be towed ashore, cut up, and the blubber tried out in rude try works.

The first mention in the local newspapers of this fishery was the following, from the *Polynesian*, of Honolulu, May 20, 1848:

> Sperm whales are frequently seen near these islands, and several projects have been set on foot at different times to capture them. Mr. James Hough, of Lahaina, obtained a few months since a charter for the exclusive right of fishing for whales at Honuaula, on the island of Maui, and at length succeeded in capturing a sperm whale. In consequence of the difficulty experienced in "cutting in" and getting the "blubber" on shore, only about 30 barrels of oil were secured. This at the current rates here is worth about $800.

Maalaea Bay, on the north side of Maui, was frequently visited by sperm whales. According to several of the old inhabitants of Wailuku the natives used to kill whales in the bay quite often in the "forties."

Whales would sometimes get stranded upon the coast. In June, 1857, a young sperm whale, about 8 feet in length, was stranded on the beach at the mouth of the Waiole River, Hanalei Bay, Kauai. The natives secured him and floated him into the river, where he soon died, and his oil was then tried out.

In the *Pacific Commercial Advertiser*, of Honolulu, under date of March 11, 1858, appeared the following:

> The season for humpback whales amongst these islands extends from January to April. The four or five whaling companies at or near Lahaina have not as yet succeeded in securing a whale, but a company of natives from Honolulu stationed at Lahaina killed a cow and a calf there on the 1st of March, while a boat from the *Sharon*, lying at anchor, captured the male which was in company. From Hilo our correspondent gives an account of the taking of a whale in that harbor by the boats of the *Dover*. A school of these whales were seen off the entrance of our harbor yesterday morning.

In 1859 three stations for bay whaling were opened in and around Kalepolepo Bay, on Maui. On April 8, 1862, Mr. O. J. Harris, of Lahaina, captured a large bowhead whale in this bay. When tried out it yielded about 50 barrels.

A small sloop, the *Laanui*, O. J. Harris, captain, was engaged in the business in 1863 and met with considerable success, while Mr. Pat Shaw, of Lahaina, with a crew from the same place, was very successful in bay whaling during the "sixties."

In 1870 the *Anne*, Captain Roys, of Honolulu, engaged in bay whaling at Kalepolepo Bay. Try works were erected at Oloalu, some 4 or 5 miles beyond Lahaina. Captain Roys used an explosive gun of his own design and met with considerable success.

In March, 1870, a whale was caught off Hilo, Hawaii, by a shore party from that place. They obtained 75 barrels of oil from it.

The vessel *Henrietta*, of Honolulu, engaged in the fishery in 1872 around Lahaina and was quite successful. She got one whale in Maalaea Bay which tried out 50 barrels, worth about $1,000. A shore party under O. J. Harris was also working in the same vicinity at that time and met with considerable success.

Whales are still seen quite frequently each year around the islands, but little attention is paid to them unless one should be stranded, when the natives gladly seize upon it.

THE FOREIGN WHALING FLEET AT THE ISLANDS.

One of the principal causes of the present material wealth of the islands was the rendezvousing of the Pacific whaling fleets from the United States and other countries at the various ports of the islands for many years, and the transshipment of oil and bone from these ports. An effort is made herewith to show the history and extent of this business so far as can be done from the data available.

The first whaler to enter the Pacific Ocean was the ship *Amelia*, Captain Shields, from London, in 1788. She was fitted out at vast expense by Mr. Enderby, a London merchant, and carried a crew of Nantucket, Mass., whalers. She sailed on September 1, 1788, and returned March 12, 1790, with a cargo of 139 tons of sperm oil. She received a bounty of 800 pounds from the Government. Most of the whaling was done off the coasts of Chile and Peru. Capt. Archetus

Hammond, of Nantucket, Mass., was first officer of the ship and struck the first sperm whale ever known to be taken in that ocean.

The success of the *Amelia* stimulated other nations, and the United States was among the first to fit out vessels for this fishery. In 1791 Nantucket people built and sent three new ships, with three old ones, into the Pacific Ocean, the first from the United States. These were very successful, each ship obtaining up to 1,500 barrels of oil, mostly sperm. The first of the ships to enter the Pacific was one of the new vessels, the *Beaver*, Paul Worth. She was also the first to return.

In 1802 whaling was prosecuted first off New Zealand, and in 1803 the whalers were in the China seas about the Molucca Islands.

The first American whalers to visit the Hawaiian Islands were the ships *Balæna* and *Equator*, of New Bedford. They arrived at Kealakekua Bay, Hawaii, September 17, 1819, off which port they captured a large sperm whale which yielded 102 barrels. They sailed thence on October 1, for Lahaina to water, and touched off Oahu, to leave letters, October 10. At this time Honolulu is described as a scattered, irregular village of thatched huts, of 3,000 or 4,000 inhabitants. By 1820 the calls of whalers at Honolulu were quite frequent. In 1823 there were four American mercantile houses established there, two of Boston, one of New York, and one of Bristol, R. I. The Americans were quick to see the superiority of the islands for recruiting and refitting over other stations in the Pacific, and very soon all the American vessels in the Pacific, and quite a few from other countries, were touching at the islands regularly.

The discovery of the sperm whaling-ground off the Japan coast in 1819 by the *Syren*, Captain Coffin, where she had great success, drew large numbers of the new vessels, particularly American, to the new grounds, and these fixed their headquarters at the islands. Capt. Joseph Allen, of the ship *Maro*, of Nantucket, also discovered these grounds independently in 1820.

Stimulated by the demand on the products of the islands created by the great influx of foreign whalers, strenuous efforts were put forth to furnish the supplies desired. The island of Maui was noted for its potatoes and wheat, and most of the whalers called at Lahaina specially for supplies of these articles. In 1828 potatoes were rather scarce and sold in Honolulu for $2 per barrel, but were cheaper at Lahaina.

According to the *Daily Advertiser* (Boston, Mass.), of December 24, 1874, the first whaling in the Ochotsk Sea was done by American whalers in 1834. The whales were reported by the master of the American schooner *Unity*, of 60 tons, which was bound to the port of Ochotsk, in Siberia, and thence to Kamchatka.

In August, 1820, Captain Meek, in the trading brig *Peddler*, of New York, visited the Arctic Ocean. He secured by trade some oil and bone from the natives. It was partly on his recommendation later that whaling was begun there.

Captain Roys, of the bark *Superior*, of Sag Harbor, N. Y., was the first to go into the Arctic for whales. In the Honolulu *Friend* he gave the following account of the opening up of this profitable region:

I entered the Arctic Ocean about the middle of July, and cruised from continent to continent, going as high as latitude 70, and saw whales wherever I went, cutting in my last whale on the 23d of August, and returning through Bering Strait on the 28th of the same month. On account of powerful currents, thick fogs, the near vicinity of land and ice, combined with the imperfection of charts and want of information respecting the region, I found it both difficult and dangerous to get oil, although there were plenty of whales. Hereafter, doubtless, many ships will go there, and I think there ought to be some provision made to save the lives of those who go there should they be cast away.

The discovery of this new ground was of inestimable value, as sperm whaling was rapidly dying out, owing to the scarcity of these animals and the new grounds were soon visited yearly by a large fleet of vessels, principally American. The whales secured in this region were of the bowhead or Greenland variety.

From the very beginning American whalers predominated at the Hawaiian Islands. In the "twenties," Great Britain was a somewhat serious competitor, but she was soon hopelessly distanced. The reasons for this are well set forth in the following quotation from one who was in a position to know, and who had no love for Americans:*

The number of vessels fitted out from England for the whale fishery of the Pacific was, in 1820, 140, while at present there are not more than 70, the Americans having at least 400 vessels profitably employed in this trade. Say about 24,500 tons British shipping and 2,100 seamen; ditto 130,000 tons of American shipping and 12,000 seamen. This disproportion is but slightly altered by the vessels fitted out from British colonies.

The protection to British fishing vessels was, up to July, 1843, no less than £25 12*s.* per ton on all oils, and is now £15 15*s.* on spermaceti oil and £6 6*s.* on black oil. Yet there is a falling off in their number of one-half during the last twenty years, while the American vessels have increased in a greater ratio.

It would be easy to detail the causes of the greater success of the Americans in conducting this profitable trade; among the more prominent of which are, the greater sobriety of the officers and the superior character of the crews, both which—recommendations in any trade—are indispensable in the prosecution of this one.

He was anxious for Great Britain to seize the islands and make Honolulu a depot for the British whaling interests, and created a great deal of trouble for the native government before he was recalled.

The first French whaler to call at the islands was the *Nancy*, in 1837, but French vessels called quite frequently after this. The first Prussian and Danish whalers to visit the islands was in 1842.

The native government was quick to realize the benefits of this trade, and made every effort possible to attract the whalers to the islands. In 1844 the following regulations in regard to whalers were in force at the various ports of the islands:

General regulations.—Whalers were permitted to sell goods to the amount of $200 each without paying any duty whatever. On all

*The Sandwich Islands, etc. By Alexander Simpson, esq., late acting there as Her Majesty's consul. Pamphlet published in London, 1842.

above $200 they paid an ad valorem duty of 3 per cent. Goods were allowed to be transshipped or reexported on payment of a duty.

Honolulu.—The harbor dues at this port were as follows: Six cents per ton on whale ships and merchant vessels entering for the purpose of obtaining refreshments only. For the use of the buoys, $2. For certificate of clearance, $1. Per foot pilotage for taking a vessel in or out, $1.

Lahaina.—Regulations of port: Every captain requiring refreshments had to pay $10 for the harbor dues, for which he was allowed 5 barrels of potatoes and the privilege of purchasing supplies for his ship. Every ship on arriving and making purchases had to pay $1 for the support of two lights kept burning to mark the place where boats could land. The captain was compelled to secure a certificate showing that the port regulations had been complied with; charge for this, $1.

Hilo.—Harbor dues for whalers: For anchorage, $6; for pilotage, $6.

Kealakekua.—Harbor dues for whalers: For anchorage, $6; for pilotage, $6.

In the general laws of 1846 no duty was charged on the transshipment of whale products at the ports of the islands.

In 1847 the following law to encourage the visits of whalers was passed by the Legislative Council of the islands:

SECTION I. *Be it resolved by the nobles and representatives of the Hawaiian Islands in Legislative Council assembled,* That in order to encourage the visits of whale ships of all nations to the ports of entry for such vessels now open by the existing laws, or hereafter to be declared open, they and each of them, on and after the proclamation hereof in the Polynesian newspaper, be exempted from all anchorage fees and tonnage dues imposed by the existing tariff upon vessels exclusively engaged in the whale fishery; in all cases so long as said vessels shall not exceed in their trade or barter in foreign goods the amount of $200 ad valorem allowed by law to be landed from them free of duty, provided brandy, wine, or other liquors which have an intoxicating effect be entirely excluded from that trade or barter, any vessel trading or bartering in which shall wholly forfeit the advantage of this resolution.

SEC. II. *And be it further resolved,* That from and after the proclamation hereof as aforesaid, the harbor or roadstead of Kealakeakua, on the island of Hawaii, shall be and is hereby created a port of entry and departure for whale ships in accordance with the existing laws applicable to such vessels at the other ports already opened to whale ships.

SEC. III. *And be it further resolved,* That the minister of finance be and he is hereby authorized to pay out of any moneys in the exchequer the drafts of the collector-general of customs in favor of any duly appointed pilot employed at the port of Honolulu the sum of $25 for each whale ship which shall have been promptly and faithfully piloted by him in and out of the port of Honolulu in lieu of the $1 per foot allowed by law to be charged for the pilotage of whale ships.

SEC. IV. *And be it further resolved,* That the minister of finance be and he is hereby authorized to pay to the pilots appointed for Lahaina, Hanalei, and Hilo out of any moneys in the exchequer such gross sums per annum as may be recommended by the board of finance in lieu of the charge which they are authorized to make for the pilotage of whale ships.

SEC. V. *And be it further resolved*, That the joint resolution of 3rd April, 1846, relative to brandies, wines, and other spirituous liquors shall be understood and is hereby interpreted to mean as follows: The permits to trade or barter, given to vessels engaged in the whale fishery, do not and shall not include the trade, sale, landing, or disposal of spirituous liquors, but all such traffic on the part of said vessels shall be and is hereby construed to constitute them merchantmen, and shall subject them, within the meaning of said joint resolution, to the payment of 20 cents per ton tonnage dues, as well at the anchorage of Lahaina and the roadstead of Honolulu as at anchor in the harbor of Honolulu, and to all other legal liabilities.

SEC. VI. Relates to fees for various kinds of general licenses.

SEC. VII. Relates to the breaking up of hulks.

SEC. VIII. *And be it further resolved*, That from and after the proclamation hereof as aforesaid no clearance shall be given by any collector of customs to any foreign vessels at any port in this Kingdom where there is or shall be a consul, vice-consul, or commercial agent, or vice commercial agent of the nation to which such vessel belongs until the master or commander of such vessel shall produce to said collector a certificate under the seal of his consul that all legal charges and demands in his office against said vessel have been paid and that he knows of no reason why said vessel should not immediately depart; and that in ports where no such consul, vice-consul, or commercial agent, or vice commercial agent may exist the local collector shall otherwise satisfy himself that all proper and legal charges have been paid before granting a clearance to any foreign vessel.

SEC. IX. *And be it further resolved by the authority aforesaid*, That from and after the proclamation hereof in manner aforesaid, all, each, and every, the provisions of the foregoing *eight* resolutions shall be considered, received, taken, and construed to be amendments to the existing laws of this Kingdom, and that they be substituted instead of any such laws at conflict therewith, which existing laws, so far as the same are found to be so at conflict, are and shall be hereby repealed.

The effect of this law was to make all the ports free ports.

Section 8 of the above act was repealed on May 26, 1853.

The following act regulating the duties on the products of the whale fishery was approved July 27, 1852:

SECTION 1. All oil, bone, and other products of the sea taken by an Hawaiian vessel may be imported into this Kingdom free of duty, but the same shall be entered and permitted at the custom-house in the same manner as goods liable to 5 per cent ad valorem duty.

SEC. 2. All oil, bone, and other products of the whale fishery imported into this Kingdom in any foreign vessel, or being the product of any foreign vessel and sold or landed, shall be considered to have been imported for consumption, and shall be liable to the duty of 5 per cent ad valorem and not entitled to any drawback for reexporting unless the same shall have been stored in the custom-house stores or under the direction of the collector of customs.

SEC. 3. This act shall take effect on the thirtieth day after its passage.

As the remitting of the pilot dues was quite a serious drain on the financial resources of the Government, they were reimposed in 1850. On August 16, 1854, however, all tonnage dues on whalers, foreign and domestic, were abolished.

The usual custom was for the whalers to make two cruises each year. The first, or spring season, was from January 1 to about June 14, the second, or fall season, beginning about July 27 and ending about October 10. The intervening time was employed in refitting for the

next season. During the spring season the vessels usually visited some of the southern grounds for sperm or right whales, or both, while during the fall season the North Pacific and Arctic grounds were visited.

American vessels, which hailed principally from New Bedford, New London, and Nantucket, engaging in the Pacific and Arctic fishery, usually left their home port in the fall of the year so as to make the passage of the Horn or Cape of Good Hope in the southern summer. These ships would arrive at the islands in March or April, in time to refit for the fall cruise. An American vessel whaling in the Arctic usually remained out three and one-half or more years, including the time spent in coming from and returning to her home port.

It was quite common for the whalers to come to the islands on the outbound passage with only enough men to work the vessel. They would then engage young natives, called "Kanakas," to fill out the crew, bringing them back to the islands before starting on the homeward journey. From January 1 to December 31, 1843, 44 of the natives were serving in whalers, and from January 1, 1844, to June 1, 1844, there were 70 so employed, all engaged at Honolulu. Probably as many more were engaged by vessels calling at the other ports of the islands. In 1865, 400 shipped on American whalers alone. In 1869, 488 Kanakas were employed on whalers, their lay for the season amounting to $45,700, while 388 were shipped in 1871 from Honolulu on the spring and fall whalers, and 378 returned to port, 10 having died during the year. The Kanakas were very popular with the captains, as they made good seamen and whalemen and were easily managed.

At first the Government took no particular interest in this part of the business, but in time the abuse of and cheating of the men by dishonest and brutal captains became so notorious that the Government was compelled to adopt regulations in regard to the matter. Under these the master of the vessel had to execute a bond that he would obey the laws, which were that he could not hire a Kanaka for more than two years, was to return him to the island at the expiration of his time, and was to pay him his proper lay of the products taken during the cruise.

From 1840 to 1860 were the palmy days of whaling in the North Pacific and Arctic. The number of vessels visiting Honolulu would be so great and the inner harbor so packed that it is said one could go all around the harbor by stepping from one vessel to another, while in the outer harbor would be almost as many more which had been unable to get in.

As the harbor at Lahaina is nothing but an open roadstead, protected from the prevailing winds by the high mountains of the island itself, there was more room. As many as 89 whalers were counted at anchor here at one time during the period above stated.

The ship-chandlery business for whalers virtually began at Honolulu in 1843. From this time on a number of firms made it their regular business. The following summary of an article appearing in the *Polynesian*, Honolulu, April 20, 1861, gives a very good idea of the extent to which Honolulu was benefited by the visit of whalers:

For the twelve years from 1849 to 1860, both inclusive, it is stated that 4,929 callings at ports on the islands were made by whalers. Domestic supplies to the extent of $1,382,413 were furnished to them. It is estimated that these 4,929 ships, averaging 30 men each (147,870), expended $30 each at the islands, which would amount to $4,436,100. It is also estimated that the repairs to the fleet amounted to $180,000.

The following table shows for certain years between 1846 and 1875, both inclusive, the value of supplies furnished to foreign whalers at Honolulu, together with the number of vessels so supplied for certain years:

Years.	Value of supplies.	Number of vessels supplied.	Years.	Value of supplies.	Number of vessels supplied.
1846	$468,000		1863	$13,200	44
1847	78,200	167	1864	65,000	93
1849*	27,000	108	1865	50,400	
1850*	26,500	106	1866	69,000	
1851	18,400	82	1867	72,100	
1852	49,720	226	1868	56,800	
1853	67,650	246	1869	46,200	
1854	51,975	189	1870	33,600	
1857	106,750	122	1872	10,500	
1858	109,850	169	1873	16,600	
1859	85,000	170	1874	12,500	
1861	38,500	77	1875†	7,200	
1862	21,000	42			

*Only shows value of supplies furnished to vessels in the inner harbor. There is no record of the supplies sold to vessels in the outer harbor.
†No separate record was kept by the custom-house after 1875.

The profits in this business were enormous for a time, and it has been well said that "Honolulu was built upon the whale business." No specific records were kept of these matters at Lahaina, but it is known that during 1849 the supplies furnished to whalers amounted to $38,500, while in 1850 they amounted to $24,640.

The first recorded transshipment of whaling products was in 1846, when some whalebone was so handled. The business practically began, however, in 1851, and was of immense benefit to Honolulu, as this harbor was the principal scene of operations. As wharves were practically nonexistent at this time, the hulks of old whalers and merchantmen were used as storage places for the oil and bone until vessels were ready to load for home ports. The whalers would usually store their catch here on their return from a cruise, then refit and start on another cruise. Regular clipper ships would call at the islands, bringing out supplies, and return with a cargo of bone and oil. On November 10, 1857, the clipper ship *John Land* sailed from Honolulu with a cargo of oil and bone for New Bedford valued at $635,556.

The following table shows the transshipments of oil and bone from 1851 to 1875 (the business practically ceased in the latter year):

Years.	Sperm oil.	Whale oil.	Whale-bone.	Ivory.
	Gallons.	*Gallons.*	*Lbs.*	*Lbs.*
1851	104,362	909,379	901,604	.....
1852	173,490	1,182,738	3,159,951	.....
1853	175,396	3,787,348	2,020,264	.....
1854	146,484	1,665,921	1,508,443	.....
1855	109,308	1,436,810	872,954	.....
1856	121,294	1,641,579	1,074,942	.....
1857	176,306	2,018,027	1,295,525	.....
1858	222,464	2,551,382	1,614,710	.....
1859	156,360	1,668,175	1,147,120	.....
1860	47,859	782,086	571,966	.....
1861	20,435	795,988	527,910	.....
1862	12,522	460,407	193,920	.....
1863	56,687	675,344	337,043	.....
1864	33,860	608,502	339,331	.....
1865	42,841	578,593	337,394	.....
1866	118,961	1,250,965	611,178	.....
1867	103,215	821,929	405,140	.....
1868	106,778	774,913	596,043	.....
1869	157,690	1,698,189	627,770	.....
1870	105,234	1,443,809	632,905	.....
1871	63,310	283,055	29,362	.....
1872	50,887	32,974	81,998	.....
1873	56,687	573,697	122,554	25,108
1874	23,187	403,876	174,111	56,552
1875	37,812	312,305	104,715	14,909

NOTE.—Includes the shipments of the Hawaiian vessels.

The principal portion of the products were shipped to New Bedford either by clipper ships sailing around the Horn or to Panama by sailing vessel, thence by rail across the Isthmus to Colon, and from there by sailing vessel or steamer to Atlantic ports. A part also went to San Francisco and thence by rail to Eastern points after the Pacific Railroad was completed. A considerable portion went to Bremen, Germany, and for a few years some went to Havre, France. Great Britain and New South Wales also received a few shipments.

The following table shows for certain years between 1852 and 1875 the countries to which the transshipped products were sent:

Table showing the countries to which the transshipped foreign and domestic products of the whale fishery were shipped.

Years.*	United States.				Germany.		
	Sperm oil.	Whale oil.	Whale-bone.	Ivory.	Sperm oil.	Whale oil.	Whale-bone.
	Gallons.	*Gallons.*	*Lbs.*	*Lbs.*	*Gallons.*	*Gallons.*	*Lbs.*
1852	172,418	1,133,259	3,078,019	.....	1,072	49,479	81,932
1853	174,920	3,750,310	1,956,405	.....	.....	.....	14,819
1854	156,484	1,630,005	1,435,345	.....	.....	10,244	26,288
1857	120,694	1,666,193	1,058,959	.....	.....	.....	.....
1858	203,076	2,217,616	1,428,760	.....	488	123,648	79,950
1859	154,205	1,365,866	1,016,812	.....	1,473	284,667	110,499
1860	47,859	713,323	.....	.....	.....	69,773	33,742
1864	29,486	529,210	292,377	.....	4,374	79,202	46,954
1865	42,841	529,449	290,656	.....	.....	49,144	46,738
1866	118,961	1,235,489	593,117	.....	.....	15,476	18,061
1867	101,344	786,947	350,361	.....	1,871	34,982	54,769
1868	104,920	733,805	496,784	.....	.....	41,108	99,259
1869	154,569	1,578,814	527,578	.....	3,121	119,375	100,192
1870	105,234	1,304,088	515,698	.....	.....	139,721	117,207
1871	60,112	142,736	29,079	.....	3,198	140,319	283
1872	21,288	50,789	67,292	.....	98	11,686	14,706
1873	56,687	573,131	122,554	25,108	.....	566	.....
1874	10,606	366,066	170,642	56,552	.....	18,667	.....
1875	34,380	268,789	67,047	9,828	597	27,136	†25,517

* The records are missing for the years not given between 1852 and 1875.
† 7,118 pounds of ivory were also exported to Germany.

Table showing the countries to which the transhipped foreign and domestic products of the whale fishery were shipped—Continued.

Years.	France.			Great Britain.		Australia (New South Wales).		
	Sperm oil.	Whale oil.	Whalebone.	Whale oil.	Whalebone.	Sperm oil.	Whale oil.	Whalebone.
	Gallons.	*Gallons.*	*Lbs.*	*Gallons.*	*Lbs.*	*Gallons.*	*Gallons.*	*Lbs.*
1853	476	37,038	28,200	.....	21,040	.....	.....	.....
1854	.....	25,172	46,810	.....	.....	.....	.....	.....
1857	600	35,400	16,000	.....	.....	.....	.....	.....
1858	.....	.....	.....	25,155	.....	.....	.....	.....
1859	682	17,642	19,809	.....	.....	.....	.....	.....
1874	.....	.....	.....	.....	.....	2,581	10,143	3,469
1875	.....	.....	.....	.....	.....	2,835	16,380	6,000

The year 1875 was practically the last one in which oil and bone were transshipped at the islands. For some years San Francisco had been endeavoring to persuade the whalers to make that port their refitting and transshipping point. During the gold excitement a few vessels did call there, but they were put to such great expense and delays by the desertions of their men that they ceased calling except when absolutely necessary. During the late "sixties," however, a few resumed their calls, and these kept on increasing until in 1875 nearly all of the American fleet called there. In 1871 the Pacific Railroad provided tank cars and agreed to transport the oil to New Bedford at the rate of 7 cents per gallon, and this had a great deal to do with drawing the whalers to San Francisco. At present San Francisco is the port of call for all of the Pacific and Arctic fleet.

After 1860 the fleet rapidly declined in numbers. During the civil war in the United States a number of them were withdrawn by their owners, owing to the fear of Confederate cruisers. In 1860, 293 calls were made at ports in the islands by Americans, while in 1862 there were only 57. After this they increased somewhat in number until in 1865 there were 162. In this year the Confederate steamer *Shenandoah* destroyed 34 ships and barks of the Arctic fleet.

In 1871, 30 out of 37 vessels of the American Arctic fleet were caught in the ice off Point Belcher and the crews were compelled to abandon them to their fate. The fleet had hardly begun to recover from this crushing blow when, in 1876, half of the fleet of 16 American vessels were caught in the ice and destroyed. As the fleet practically ceased to visit the islands regularly after 1875, its subsequent history does not come within the province of this paper.

Vessels called at the islands occasionally, however, even after 1875. According to Capt. D. Taylor, of Lahaina, the *Nimrod*, of New Bedford, was the last whaler to call at Lahaina. This was in March, 1886. The last visit of whalers at Honolulu was in 1896, when 2 American and 3 British vessels called.

The following table shows by nationality the visits of the foreign whalers at the islands each year from 1824 to 1896, both inclusive:

Years.	Belgium.	Chile.	Denmark.	France.	Germany.*	Great Britain.	Holland.	New Brunswick.	New South Wales.	Norway.	Russia.	Tahiti.	United States.	Nationality not given.	Total number of visits.†
1824	.....	.....	.....	.....	.....	15	.....	.....	.....	.....	.....	.....	48	.....	63
1825	.....	.....	.....	.....	.....	17	.....	.....	.....	.....	.....	.....	38	.....	55
1826	.....	.....	.....	.....	.....	16	.....	.....	.....	.....	.....	.....	91	.....	107
1827	.....	.....	.....	.....	.....	18	.....	.....	.....	.....	.....	.....	64	.....	82
1828	.....	.....	.....	.....	.....	28	.....	.....	.....	.....	.....	.....	84	.....	112
1829	.....	.....	.....	2	.....	26	.....	.....	.....	.....	.....	.....	83	.....	111
1830	.....	.....	.....	.....	.....	19	.....	.....	.....	.....	.....	.....	75	.....	94
1831	.....	.....	.....	.....	.....	21	.....	.....	.....	.....	.....	.....	60	.....	81
1832	.....	.....	.....	.....	.....	17	.....	.....	.....	.....	.....	.....	101	.....	118
1833	.....	.....	.....	.....	.....	18	.....	.....	.....	.....	.....	.....	89	.....	107
1834	.....	.....	.....	.....	.....	17	.....	.....	.....	.....	.....	.....	95	.....	112
1835	.....	.....	.....	.....	.....	10	.....	1	.....	.....	.....	.....	62	.....	73
1836	.....	.....	.....	.....	.....	16	.....	1	.....	.....	.....	.....	57	.....	74
1837	.....	.....	.....	1	.....	24	.....	.....	.....	.....	.....	.....	104	.....	129
1838	.....	.....	.....	4	.....	15	.....	.....	.....	.....	.....	.....	129	.....	148
1839	.....	.....	.....	2	.....	3	.....	1	.....	.....	.....	.....	108	.....	114
1840	.....	.....	.....	2	.....	4	.....	.....	.....	.....	.....	.....	80	.....	86
1841	.....	.....	.....	2	.....	8	.....	.....	.....	.....	.....	.....	123	7	140
1842	.....	.....	2	10	1	22	.....	3	.....	.....	.....	.....	137	2	177
1843	.....	.....	.....	2	5	4	.....	3	1	.....	.....	.....	232	34	281
1844	.....	.....	2	26	19	5	.....	4	.....	1	.....	.....	438	.....	495
1845	.....	.....	2	30	9	11	.....	3	.....	1	.....	.....	479	5	542
1846	.....	.....	.....	24	21	13	1	.....	.....	.....	.....	.....	537	.....	596
1847	.....	.....	.....	22	22	3	.....	.....	.....	.....	.....	.....	359	.....	406
1849	.....	.....	.....	7	5	1	.....	.....	.....	.....	.....	.....	261	.....	274
1850	.....	.....	.....	14	10	2	.....	.....	.....	.....	.....	.....	211	.....	237
1851	2	.....	.....	8	12	2	.....	.....	.....	.....	.....	.....	196	.....	220
1852	.....	2	.....	20	12	1	.....	.....	.....	.....	1	.....	482	.....	518
1853	.....	.....	.....	17	12	.....	.....	.....	.....	.....	4	.....	500	.....	533
1854	.....	2	.....	22	8	.....	.....	.....	.....	.....	1	.....	490	.....	523
1857	.....	.....	.....	9	2	.....	.....	.....	.....	.....	1	.....	350	.....	362
1858	.....	.....	.....	15	3	.....	.....	.....	.....	.....	5	.....	488	.....	511
1859	.....	.....	.....	19	3	.....	.....	.....	.....	.....	8	.....	505	.....	535
1860	.....	.....	.....	4	9	.....	.....	.....	.....	.....	4	.....	293	.....	310
1861	.....	.....	.....	3	5	.....	.....	.....	.....	.....	1	.....	172	.....	181
1862	.....	.....	.....	5	3	.....	.....	.....	.....	.....	.....	.....	57	.....	65
1863	.....	.....	.....	.....	4	3	.....	.....	.....	.....	.....	.....	92	.....	99
1864	.....	.....	.....	4	4	1	.....	.....	.....	.....	.....	.....	112	.....	121
1865	.....	.....	.....	5	3	1	.....	.....	.....	.....	.....	.....	162	.....	171
1866	.....	.....	.....	1	3	2	.....	.....	.....	.....	.....	.....	220	.....	226
1867	.....	.....	.....	2	4	1	.....	.....	.....	.....	.....	.....	227	.....	236
1868	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	2	143	.....	147
1869	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	89	.....	89
1870	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	101	.....	101
1871	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	42	.....	‡44
1872	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	42	.....	45
1873	.....	.....	.....	.....	.....	7	.....	.....	.....	.....	.....	.....	49	.....	56
1874	.....	.....	.....	.....	.....	4	.....	.....	.....	.....	1	.....	31	.....	36
1875	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	34	.....	35
1876	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37	.....	37
1877	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	29	.....	30
1878	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	26	.....	26
1879	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25	.....	25
1880	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	.....	15
1881	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17	.....	17
1882	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32	.....	32
1884	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	.....	23
1885	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	26	.....	26
1886	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20	.....	20
1887	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	22	.....	23
1888	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17	.....	17
1889	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	18	.....	19
1890	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21	.....	21
1891	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17	.....	17
1892	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20	.....	20
1893	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17	.....	17
1894	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	17	.....	18
1895	.....	.....	.....	.....	.....	4	.....	.....	.....	.....	.....	.....	6	.....	10
1896	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	2	.....	5

NOTE.—No statistics were available for 1848, 1855, 1856, and 1883.

*Includes Bremen, Hamburg, Hanover, Oldenburg, and Prussia.

†As the same vessel sometimes visited two or three ports, and would be counted at each, this total necessarily does not represent the real number of vessels. It is estimated that a reduction of about one-third in the number would show the real total.

‡29 vessels were caught in the ice in the Arctic Ocean and abandoned.

From 1843 the North Pacific fishery was the most important, the Americans and Hawaiians practically monopolizing it. The following table shows the number of vessels (including only those which returned to the islands) engaged in this fishery, together with the oil and bone secured, from 1839 to 1869:

Table showing the number of vessels in the North Pacific whale fishery, and the oil and bone taken by same, from 1839 to 1869, including only the vessels that have returned to the islands.

Years.	No. of vessels.	Sperm oil.	Whale oil.	Total oil.	Whalebone.
		Barrels.	*Barrels.*	*Barrels.*	*Lbs.*
1839*	2	.....	.....	2,800	.....
1840	3	.....	.....	1,760	.....
1841	20	.....	.....	28,200	.....
1842	29	.....	.....	47,200	.....
1843	108	.....	.....	146,800	.....
1844	170	.....	.....	259,570	.....
1845	263	.....	.....	250,600	.....
1846	292	.....	.....	253,800	.....
1847	177	.....	.....	187,443	.....
1848	159	.....	.....	185,256	.....
1849	155	.....	.....	206,850	.....
1850	144	.....	.....	243,648	.....
1851†	143	.....	.....	96,177	.....
1852	275	(‡)	337,124	337,124	5,357,737
1853	252	(‡)	280,360	280,360	3,448,300
1854	245	4,276	191,843	196,119	2,698,180
1855	250	6,242	225,626	231,868	2,443,250
1856	177	3,337	135,708	139,045	1,523,650
1857	165	3,079	124,460	127,539	1,591,543
1858	218	1,555	129,240	130,795	1,667,700
1859	197	2,950	102,980	105,930	1,312,700
1860	132	2,099	63,965	66,064	838,500
1861	68	2,013	50,575	52,588	659,000
1862	34	1,685	28,315	30,000	387,500
1863	43	288	36,120	36,408	503,000
1864	55	390	29,425	29,815	428,300
1865	67	1,080	45,000	46,080	671,100
1866	76	2,643	49,056	51,699	828,991
1867	75	1,940	52,050	53,990	773,500
1868	57	2,693	38,765	41,458	539,700
1869	46	2,500	42,114	44,614	596,793

*The vessels and oil reported up to 1852 are exclusively American; since 1852 they include whalemen of all nations that have recruited after the season at the Hawaiian Islands. The coast whaling of California of late years is not included.

†A hard season, owing to the heavy ice and terrific gales; seven vessels were lost.

‡No report is obtainable for these years.

THE SEAL FISHERY.

The Hawaiians early took up the seal fishery. It is not known when the first voyage was made, but the following is an interesting summary of several made early in the last century:

March 2, 1824, by order of Kalaimoku, sanctioned by the King, he [William Summer] was given charge of the brig *Hinau* for a sealing voyage, returning in October with 5,845 fur skins, a quantity of elephant oil, and fish. On this and a similar voyage in the brig *Tamoralana* (Kamahalolanai) in 1826, in which he obtained 3,160 seal skins, he reported that much better success would have resulted had they been properly provisioned.*

On September 14, 1838, the schooner *Flibberty Gibbet*, 25 tons, Rogers, commander, owned at Oahu, returned from a twenty-one days' cruise to the island of Ceres, with a cargo of sealskins.

There are occasional notices of sealers in the maritime notes of the newspapers of the islands after this date, as in 1859, when the bark *Gambia*, 249 tons, is reported as having been sealing. She left Hono-

*Hawaiian Maritime History. Hawaiian Almanac and Annual for 1890, pp. 67, 68.

lulu on April 26, and cruised among the islands to the westward of this group, returning on August 7 with 240 barrels of seal oil, 1,500 skins, a quantity of sharks' fins and oil, etc.

Foreign sealers also touched at the islands occasionally, even as late as 1901, when a Russian and a Canadian vessel visited Waimea, on Kauai, to refit.

SEA-OTTER FISHERY.

Sea-otter skins were early traded in at Honolulu, as is shown by the following extract from the journal of one of her pioneer merchants:*

1829, April 1.—* * * Sold French a lot of sea otter skins belonging to Dana & Temple: Primes, at $35; small, at $12; reds, at $5; tail pcs., $1 each.

Many of the otter skins were obtained by merchant and whaling vessels in the course of trade. At times vessels would be fitted out especially for the fishery, as mentioned in the following quotation referring to the year 1835:

Upward of 20 sail, chiefly British and American whale ships, anchored in the port of Honorum [Honolulu] while we continued there. One of them was a fine brig, the property of an American merchant, resident at this island. She was engaged in the fur trade on the northwest coast of America, was commanded by Captain Bancroft, an Englishman, and carried as part of her crew 23 Northwest Indians, who had been engaged to shoot the sea otter. The latter people are found to be tractable when on distant seas, although prone to treachery when on their own coast. They were paid by the owner of the vessel the market price of each fur skin they obtained, or, more commonly, to the same amount in such European commodities as they required, namely, blankets, knives, tobacco, and spirits.†

In 1837 sea-otter skins to the value of $29,000 were exported from the islands.

There is no further mention of the industry in any of the available records, and it is probable that it was given up at an early date, as the islands were too far from the hunting-grounds.

SHARK FISHERY.

During the latter half of the last century particularly, considerable shark fishing was done among the chain of islands to the westward of the main group, and these islands in time came to achieve an unenviable notoriety from the number of wrecks which occurred upon their shores. The first record we have of this fishery was in 1859 when the bark *Gambia* returned from a three and one-half months' cruise amongst these islands with, among other things, a quantity of sharks' fins and oil. In 1872 the *Henrietta* made a cruise among the islands for the same purpose. In 1886 the schooner *General Seigel*, while on a shark-fishing cruise, parted her cables and went ashore at Midway

* Honolulu in Primitive Days. As seen by extracts from the journal of one of her pioneer merchants during the years 1826 to 1829. The Hawaiian Almanac and Annual for 1901.

† Narrative of a Whaling Voyage round the Globe, from the Year 1833 to 1836, etc. By Frederick Debell Bennett, vol. 1, p. 402. 2 vols., London, 1840.

Island, and the crew only reached safety in an open boat after great privations. Very little shark fishing has been done of late years owing to the lack of a profitable market for the products obtained.

Sharks' teeth were highly prized by the natives, while the oil extracted was valuable and of a good quality. After an export trade had been opened with other countries considerable quantities of sharks' fins were dried and shipped to China and San Francisco.

THE PEARL FISHERY.

During the early years of the last century pearl oysters were first discovered in the locality now bearing the name of Pearl Harbor, about 9 miles from Honolulu—a magnificent sheet of water, running about 10 miles back into the interior, and about 4 miles across in the widest part. It is divided into two parts by an island and a narrow strip of the mainland running down about the center of it. The beds were located at the head of the harbor. As the value of the discovery soon became manifest the King declared it a royal monopoly, and he employed divers to bring up the oysters, which were found in great plenty.

Speaking of the marine fauna, James Jackson Jarves, the historian of the islands, says:

> Edible shell-fish are also abundant, of which the pearl oyster is very palatable. Pearls are common, but of no great size or beauty. They formerly constituted a profitable branch of trade and were monopolized by the king.*

The shell, or mother-of-pearl, formed the more valuable part of the product and was usually shipped to China, where it found a ready sale, but the business was so vigorously prosecuted that before 1850 it had ceased to exist, owing to the exhaustion of the bed.

Pearls have been found on the Puna coast, on Hawaii, inclosed in a large mollusk, shaped like a pearl oyster, and called "pa" by the natives. The pearls are of but little value, owing to dark streaks in the center of them. The natives use the portion of the shell around the valve in making fishhooks, as this part has the rough outline of a hook already and is easily worked. This mollusk is quite rare now and is highly prized by the natives when found.

LOLI (BÊCHE-DE-MER) FISHERY.

This is an edible Holothurian much esteemed by the Chinese for its supposed medicinal qualities, and is prepared by them in the form of a soup. It is a gelatinous slug, found in the sea from low-water mark to a depth of several fathoms, and grows from 3 to 10 inches in length. When taken from the rocks, to which it is generally found adhering, it is cut open, the entrails removed, and the body is then dried in the sun. After being thus prepared it is of a dark or black color. Vari-

*A history of the Hawaiian or Sandwich Islands, etc. By James Jackson Jarves. p. 13. Boston, 1843, 8vo.

ous species of these Holothurians are quite generally distributed in the Pacific Ocean, and the traffic in them was started among the South Sea Islands in the early years of last century, China and Manila being the principal markets. Up to 1861 no attempt was made to take up the industry on the islands. In that year Messrs. Utai & Ahee, a Chinese firm in Honolulu, advertised in the local papers that they would purchase cured bêche-de-mer from the natives if it could be found. This stimulated the natives and they soon found it in large numbers. Since then the custom-house reports show the following exports for certain years:

	Pounds.		Pounds.
1861	6,507	1864	7,135
1862	5,809	1867	4,958
1863	5,500	1876	1,125

As a commercial fishery the industry did not last very long for some reason or other. It is still quite abundant, however, especially around Oahu and Maui. The only island where any were sold in 1900 was Maui. It is frequently eaten by the natives, who half boil the large ones to make them soft, while the small ones are eaten fresh. The boiled ones are chopped up in slices and mixed with the meat of the wana (sea egg).

NOTES

ON

THE FISHERIES OF THE PACIFIC COAST IN 1899.

BY

WILLIAM A. WILCOX.

NOTES ON THE FISHERIES OF THE PACIFIC COAST IN 1899.

By William A. Wilcox.

The present investigation of the Pacific coast fisheries of Washington, Oregon, and California is the fourth one the writer has made for the U. S. Fish Commission between 1889 and 1899. Favorable opportunities have therefore been afforded to observe the changes from time to time, and particularly the steady growth in the business, as indicated by capital, products, and number of employees, until, as here shown, it represents in capital $12,873,379, in first value of products $6,278,639, and in persons employed 19,528.

The Pacific coast fishery industries began with the taking of salmon for local use. Other fish than salmon were long disregarded, but subsequently have been marketed and will continue to be of more and more importance. Many places off the shores of Washington and Oregon in which fish are shown to be plentiful will be utilized much more in the future.

The wonderfully developed salmon-canning industry has given employment to many thousands of persons and furnishes a fine article of food that has found a market in every part of the globe. Fresh salmon has also largely increased in the quantity used and in the range of its distribution, being now quite reasonable in price not only in all the leading markets of the United States, but even in some of the countries of Europe.

The recent decrease in many valuable salmon fisheries is attributed chiefly to overfishing. This has, so far as possible, been remedied by artificial propagation, the benefits of which are being fully demonstrated and appreciated. If the salmon or other fisheries are to be sustained they must receive protection in every way. This applies to no particular section, but to any in which the fisheries are prosecuted for business or pleasure.

Several valuable species of fish hitherto unknown to Pacific waters (notably the shad and striped bass) have been introduced from Atlantic waters, and have found most favorable conditions for their existence, as shown by their remarkable increase. As the fine quality of these fish becomes generally known they add a yearly increase to the income of the fishermen at several places, but chiefly those of San Francisco

Bay and vicinity, where from $75,000 to $100,000 a year is realized by the fishermen from their capture. The general public appreciate the superior qualities of these fish, which they have at all seasons of the year, at prices lower than the same species bring at any of the markets of the Atlantic coast.

The general fresh-fish business shows a continual increase. At first supplying only a small local demand, it has grown to large proportions with the rapid growth of some sections and the improvement of transportation facilities, and has extended through the interior as far as Colorado, New Mexico, and Arizona and, to a limited extent, into Mexico.

STRIPED BASS, *Roccus lineatus.*

COMMON SHAD, *Alosa sapidissima.* Female.

The salt cod-fish business shows a slower yet steady growth, with possibilities for a largely increased demand from the more distant new possessions of the Government.

The whale fisheries of the Pacific are an exception to the general growth of the fisheries, showing but few changes from year to year. Sperm whales are said to be increasing in number, and little is now thought of a take of 1,000 barrels in a cruise of a few weeks, while formerly it took a year or longer to produce the same quantity. The low prices of oil and the expense and uncertainty of a catch of whales yielding the valuable whalebone in the more distant and dangerous

waters, near and in the Arctic Ocean, present few inducements for capital to engage in this old-time industry.

In making the several investigations noted, a large amount of statistical and general information was kindly furnished by the officials of the several railroads, express companies, and steamer lines, as well as by canners, fish-dealers, and fishermen. In collecting statistics for California, Messrs. A. B. Alexander and E. A. Tulian, of the U. S. Fish Commission, rendered valuable assistance.

The following table presents a comparison of the extent of the fisheries of the Pacific States for the years 1888, 1892, 1895, and 1899:

Comparative summary of persons employed, capital invested, and value of products of the fisheries of Washington, Oregon, and California.

States.	1888.	1892.	1895.	1899.
Persons employed:				
Washington	3,363	4,310	6,212	9,911
Oregon	3,619	4,332	6,323	5,643
California	4,684	5,403	4,770	3,974
Total	11,666	14,045	17,305	19,528
Capital invested:				
Washington	$1,261,078	$1,593,567	$2,024,469	$6,601,243
Oregon	1,859,299	2,272,351	2,637,412	3,497,643
California	2,081,950	2,526,746	2,612,298	2,774,493
Total	5,202,327	6,392,664	7,274,179	12,873,379
Value of products:				
Washington	$810,.26	$931,568	$1,402,433	$2,871,438
Oregon	733,867	872,405	1,284,136	855,750
California	2,465,317	3,022,991	1,786,479	2,551,451
Total	4,009,510	4,826,964	4,473,048	6,278,639

The above table is interesting as showing the increase during the past few years and the changes in the relative positions of the fisheries of the three States, so far as capital and products are concerned.

Within the past ten years Washington has advanced from the lowest to the highest rank in capital and products.

California has advanced in its general fish business, the decrease in persons employed resulting chiefly from the discontinuance of the seal fisheries, which at one time employed many men. California capital is also largely interested in the salmon fisheries of Alaska, which are not included in this report.

The Oregon fisheries are almost exclusively confined to the salmon industry of the Columbia and the smaller coast rivers. On account of a decreased run of salmon the products have fallen off, although there is an increase in the amount of capital invested in canneries and cold-storage plants.

The salmon fisheries were the first fisheries of the Pacific coast to be developed. At first comparatively unnoticed except by Indians and pioneers, who found in them a ready food supply, they later received the attention of capitalists, and more recently there has been a rush for favorable locations to establish salmon canneries, cold-storage

plants, and salteries in the Pacific coast States and Alaska. The tables of capital invested, persons employed, and cases of salmon canned in Washington, Oregon, and California between 1892 and 1899 will be found of interest in showing the large increase and the relative changes in amounts by species and localities. For this period the pack of the three States shows an increase of 768,232 cases of 48 one-pound cans each. The increase from 1895 to 1899 amounted to 461,734 cases, chiefly from the catch of bluebacks, of which as late as 1894 only 79,240 cases were canned, as against 523,615 cases in 1899.

CHINOOK, KING, OR QUINNAT SALMON (*Oncorhynchus tschawytscha*).

BLUEBACK OR RED SALMON (*Oncorhynchus nerka*).

The blueback, or sockeye, is one of the smallest in size and best in quality of the several species of salmon. Being rich in oil and bright red in color, it has been favorably received wherever introduced, both in this and foreign countries. This wonderful increase in the products of canned bluebacks has not resulted from any unusual abundance of fish, but from taking advantage of favorable circumstances that had long been neglected, by building a number of large canneries near the fishing-grounds of northwestern Washington, to which reports of the U. S. Fish Commission had previously called attention. It is remarkable that this valuable fishing-ground, accessible by rail

or water to the leading markets, should have so long remained almost unnoticed, while less desirable localities were being extensively developed in the distant Alaskan waters at much larger expense.

Summary, by States, of the number of cases of salmon canned in 1892, 1893, 1894, 1895, and 1899.

States.	Chinook.	Blue-back.	Silver.	Steel-head.	Dog.	Hump-back.	Total.
1892—Washington	134,253	19,441	28,708	26,945	29,411	.....	238,758
Oregon	237,684	51,106	60,293	45,403	.....	.....	394,486
California	14,334	.....	1,550	.....	.....	.....	15,884
Total	386,271	70,547	90,551	72,348	29,411	.....	649,128
1893—Washington	129,078	55,237	31,707	25,663	23,480	17,530	282,695
Oregon	176,024	23,074	62,913	39,563	9,230	.....	310,804
California	26,436	.....	500	.....	.....	.....	26,936
Total	331,538	78,311	95,120	65,226	32,710	17,530	620,435
1894—Washington	156,549	53,717	32,118	23,209	33,952	9,049	308,594
Oregon	216,507	25,523	100,087	38,829	3,162	.....	384,108
California	31,663	.....	500	.....	.....	.....	32,163
Total	404,719	79,240	132,705	62,038	37,114	9,049	724,865
1895—Washington	157,187	70,304	81,957	18,985	48,686	23,633	400,752
Oregon	316,284	12,854	138,981	30,693	27,027	.....	525,839
California	28,635	.....	400	.....	.....	.....	29,035
Total	502,106	83,158	221,338	49,678	75,713	23,633	955,626
1899—Washington	95,147	503,950	145,139	2,258	42,656	252,733	1,041,883
Oregon	214,821	19,665	78,730	9,736	18,345	.....	341,297
California	34,180	.....	.....	.....	.....	.....	34,180
Total	344,148	523,615	223,869	11,994	61,001	252,733	1,417,360

Table showing, by waters, the number of canneries and persons employed and the capital invested in the salmon industry of the Pacific States in 1899.

States and waters.	Canneries.	Employees.	Value of canneries.	Cash capital.	Total investment.
Washington:					
Straits of Fuca and Georgia and Puget Sound	19	3,461	$700,714	$1,961,977	$2,662,691
Columbia River	5	282	112,000	205,000	317,000
Grays Harbor and Willapa Bay	4	135	35,000	78,000	113,000
Total	28	3,878	847,714	2,244,977	3,092,691
Oregon:					
Columbia River	12	1,088	693,768	945,000	1,638,768
Necanicum River	1	13	3,000	10,000	13,000
Nehalem River	1	27	25,000	20,000	45,000
Tillamook River	1	30	21,400	20,000	41,400
Nestucca River	1	17	10,000	10,000	20,000
Siletz River	1	34	9,000	8,000	17,000
Yaquina River	2	30	7,000	8,000	15,000
Alsea River	1	37	10,000	10,000	20,000
Siuslaw River	1	46	13,000	12,000	25,000
Umpqua River	2	50	22,000	16,000	38,000
Coos Bay	2	51	11,000	14,000	25,000
Coquille River	2	54	10,000	20,000	30,000
Rogue River	1	59	35,000	15,000	50,000
Total	28	1,536	870,168	1,108,000	1,978,168
California:					
Klamath River	1	30	10,000	3,000	13,000
Sacramento River	3	171	60,000	79,000	139,000
Total	4	201	70,000	82,000	152,000
Grand total	60	*5,615	1,787,882	3,434,977	†5,222,859

*Includes 3,386 Chinese employed in the canneries.
†Value of vessels and fishing apparatus not included.

Table showing, by waters, the salmon pack of Washington, Oregon, and California in 1899.

States and waters.	Canneries.	Chinook.		Blueback.		Silver.		Dog.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
Washington:									
Straits of Fuca and Georgia and Puget Sound	19	24,364	$103,180	499,646	$2,368,334	111,387	$418,176	31,481	$86,427
Columbia River	5	60,133	332,306	4,304	20,310	7,337	27,592	2,686	7,387
Grays Harbor and Willapa Bay	4	10,650	46,675	.....	.....	26,415	99,056	8,489	22,470
Total	28	95,147	482,161	503,950	2,388,644	145,139	544,824	42,656	116,284
Oregon:									
Columbia River	12	195,691	1,125,869	19,665	114,413	22,271	84,463	8,693	26,449
Necanicum River	1	.....	.....	.....	.....	2,200	9,350	1,000	2,450
Nehalem River	1	1,384	5,536	.....	.....	7,405	26,658	1,288	3,864
Tillamook River	1	2,180	8,720	.....	.....	3,889	14,036	5,121	15,363
Nestucca River	1	1,109	4,436	.....	.....	3,034	10,922	513	1,539
Siletz River	1	2,200	9,900	.....	.....	2,319	8,696	200	550
Yaquina River	2	316	1,422	.....	.....	3,234	12,127	1,300	3,575
Alsea River	1	2,150	9,138	.....	.....	5,010	19,038	.....	.....
Siuslaw River	1	1,162	4,648	.....	.....	7,323	26,363	115	345
Umpqua River	2	925	3,860	.....	.....	7,576	27,006	115	345
Coos Bay	2	1,273	5,092	.....	.....	5,174	18,626	.....	.....
Coquille River	2	950	3,800	.....	.....	7,550	28,500	.....	.....
Rogue River	1	5,481	30,145	.....	.....	1,745	6,980	.....	.....
Total	28	214,821	1,212,566	19,665	114,413	78,730	292,765	18,345	54,480
California:									
Sacramento River	1	1,600	8,800	.....	.....	.....	.....	.....	.....
Klamath River	3	32,580	150,668	.....	.....	.....	.....	.....	.....
Total	4	34,180	159,468	.....	.....	.....	.....	.....	.....
Grand total	60	344,148	1,854,195	523,615	2,503,057	223,869	837,589	61,001	170,764

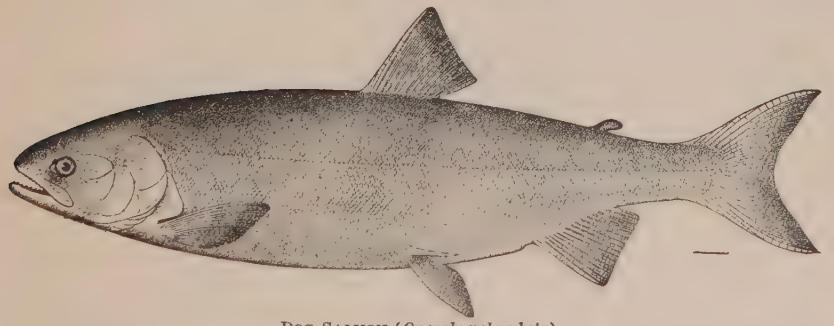
States and waters.	Humpback.		Steelhead.		Total.		Salmon utilized.	
	Cases.	Value.	Cases.	Value.	Cases.	Value.	Lbs.	Value.
Washington:								
Straits of Fuca and Georgia and Puget Sound	252,733	$734,241	.....	.....	919,611	$3,710,358	53,698,785	$1,344,681
Columbia River	.....	.....	2,258	$9,175	76,718	396,770	4,958,259	224,514
Grays Harbor and Willapa Bay	.....	.....	.....	.....	45,554	168,201	3,185,525	47,346
Total	252,733	734,241	2,258	9,175	1,041,883	4,275,329	61,842,569	1,616,541
Oregon:								
Columbia River	.....	.....	9,736	30,011	256,056	1,381,205	16,545,067	746,192
Necanicum River	.....	.....	.....	.....	3,200	11,800	295,000	6,446
Nehalem River	.....	.....	.....	.....	10,077	36,058	705,420	9,737
Tillamook River	.....	.....	.....	.....	11,190	38,119	753,605	7,577
Nestucca River	.....	.....	.....	.....	4,656	16,897	325,920	4,480
Siletz River	.....	.....	.....	.....	4,719	19,146	321,530	4,178
Yaquina River	.....	.....	.....	.....	4,850	17,124	339,500	3,548
Alsea River	.....	.....	.....	.....	7,160	28,176	501,200	5,339
Siuslaw River	.....	.....	.....	.....	8,600	31,356	781,700	12,040
Umpqua River	.....	.....	.....	.....	8,616	31,211	603,120	12,590
Coos Bay	.....	.....	.....	.....	6,447	23,718	458,790	7,364
Coquille River	.....	.....	.....	.....	8,500	32,300	593,750	10,018
Rogue River	.....	.....	.....	.....	7,226	37,125	469,690	4,697
Total	.....	.....	9,736	30,011	341,297	1,704,235	22,694,292	834,206
California:								
Sacramento River	.....	.....	.....	.....	1,600	8,800	2,119,065	61,748
Klamath River	.....	.....	.....	.....	32,580	150,668	112,000	2,100
Total	.....	.....	.....	.....	34,180	159,468	2,231,065	63,848
Grand total	252,733	734,241	11,994	39,186	1,417,360	6,139,032	86,767,926	2,514,595

A constantly growing demand for fresh fish has caused the building at several points of large cold-storage plants exclusively for freezing fish. The fish have a wide distribution throughout the United States

and large consignments of fresh salmon are also shipped to Europe. The shipments from Washington and Oregon by rail during 1899 amounted to 11,845,490 pounds, against 5,872,533 pounds in 1895.

The shipments in 1899 were as follows: From Portland, 3,473,159 pounds; from Astoria, 234,000 pounds; from Seattle, 5,173,257 pounds; from Tacoma, 1,811,300 pounds; from other points in Washington, 1,153,774 pounds; total, 11,845,490 pounds. The bulk of this large amount was salmon, with large shipments of halibut, most of which went east of the Rocky Mountains, a comparatively small proportion of the fresh fish of numerous species supplying a nearer home demand.

SILVER SALMON (*Oncorhynchus kisutch*).



DOG SALMON (*Oncorhynchus keta*).

In addition to the above, 2,190,601 pounds of pickled fish were shipped by rail from the Columbia River and Puget Sound.

GENERAL FISHERY STATISTICS OF THE PACIFIC STATES.

The three following tables show in detail the number of persons employed, the amount of capital invested, and the quantity and value of the products of the fisheries of the States of the Pacific coast in 1899:

Persons employed in the fishing industry of the Pacific States in 1899.

How engaged.	Washington.	Oregon.	California.	Total.
In vessel fisheries	544	75	942	1,561
In shore and boat fisheries	5,073	3,731	2,538	11,342
On shore, in canneries, etc	4,294	1,837	494	6,625
Total	9,911	5,643	3,974	19,528

Vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of the Pacific States in 1899.

Designation.	Washington.		Oregon.		California.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	32	$72,400	1	$6,000	33	$700,870	66	$779,270
Tonnage	889		59		5,952		6,900	
Outfit		44,715		335		413,287		458,337
Vessels transporting	72	275,200	30	66,300	15	55,800	117	397,300
Tonnage	1,222		330		834		2,386	
Outfit		86,314		4,490		4,220		95,024
Boats	2,566	233,475	1,830	198,240	1,355	150,335	5,751	582,050
Pile-drivers	30	63,283					30	63,283
Apparatus—vessel fisheries:								
Dredges	1	100					1	100
Lines, trawl and hand		5,780		400		100		6,280
Beam trawl					4	1,400	4	1,400
Guns						200		200
Seines					2	2,000	2	2,000
Apparatus—shore fisheries:								
Seines	205	93,420	46	19,910	113	11,230	364	124,560
Pound nets	540	1,552,650	65	45,200			605	1,597,850
Gill nets	1,900	119,591	2,067	297,700	1,979	166,841	5,946	584,132
Fyke nets	70	700	36	360	356	1,424	462	,484
Paranzella nets					10	1,000	10	,000
Hoop nets			2,325	1,829	1,537	3,074	3,862	4,903
Reef nets	20	600					20	600
Dip nets	55	140	12	60			67	200
Trammel nets					591	26,280	591	26,280
Shrimp nets					1,370	27,800	1,370	27,800
Fish wheels	29	66,300	47	121,300			76	187,600
Crab pots	574	685	80	80			654	765
Lobster pots					578	664	578	664
Guns and harpoons		675		100		322		1,097
Spears	88	255					88	255
Lines, trawl and hand		638				4,140		4,778
Dredges, tongs, forks, etc.		3,453		191		156		3,800
Diving outfit						3,000		3,000
Shore and accessory property		1,200,892		1,174,148		820,650		3,195,690
Cash capital		2,779,977		1,561,000		379,700		4,720,677
Total		6,601,243		3,497,643		2,774,493		12,873,379

Products of the fisheries of the Pacific States in 1899.

Species.	Washington.		Oregon.		California.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Albacore or tunny					49,202	$1,327	49,202	$1,327
Albacore, salted					65,000	2,600	65,000	2,600
Anchovies					6,826	177	6,826	177
Barracuda, fresh					957,420	23,220	957,420	23,220
Barracuda, salted					234,085	9,483	234,085	9,483
Black cod	163,500	$4,475					163,500	4,475
Bonito, fresh					50,737	1,133	50,737	1,133
Bonito, salted					69,000	2,760	69,000	2,760
Carp					283,514	2,400	283,514	2,400
Cat-fish	105,700	2,114	54,360	$1,087	465,911	12,734	625,971	15,935
Cod, salted	930,000	23,250			5,917,131	178,054	6,847,131	201,304
Croakers					40,919	1,123	40,919	1,123
Cultus-cod	91,000	1,530			147,890	3,298	238,890	4,828
Flounders, fresh	28,000	560	3,522	53	4,675,215	90,929	4,706,737	91,542
Flounders, salted					20,090	1,104	20,090	1,104
Halibut	6,860,640	191,220	17,000	1,360			6,877,640	192,580
Hardhead					185,882	5,849	185,882	5,849
Herring, fresh	424,000	2,820	19,120	347	1,620,478	17,167	2,063,598	20,334
Herring, salted					16,539	516	16,539	516
Jew-fish, fresh					36,000	751	36,000	751
Jew-fish, salted					30,000	1,200	30,000	1,200
King-fish					127,198	4,483	127,198	4,483
Mackerel, fresh					139,666	5,855	139,666	5,855
Mackerel, salted					14,000	560	14,000	560
Mullet					22,000	610	22,000	610
Perch, fresh	43,000	770	6,360	95	429,485	10,657	478,845	11,522
Perch, salted					3,000	120	3,000	120
Pike					16,005	639	16,005	639
Pompano					13,135	4,457	13,135	4,457
Rock-fish, fresh	72,000	1,440			1,177,980	35,955	1,249,980	37,395
Rock-fish, salted					54,830	2,231	54,830	2,231

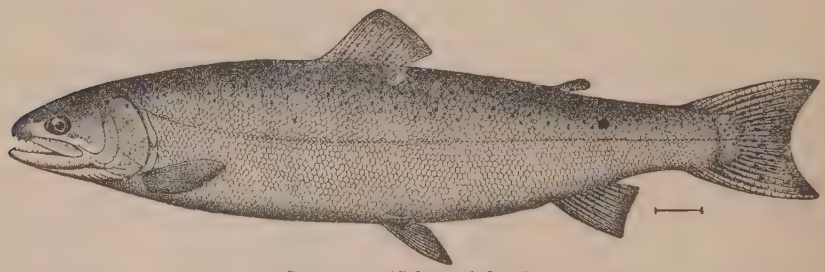
Products of the fisheries of the Pacific States in 1899—Continued.

Species.	Washington.		Oregon.		California.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Salmon:								
Blueback, fresh	41,931,194	$1,307,514	579,183	$21,293	21,600	$755	42,531,977	$1,329,562
Blueback, salted	70,000	2,801					70,000	2,801
Chinook, fresh	10,702,189	387,120	13,744,810	659,213	7,084,885	255,249	31,531,884	1,301,582
Chinook, salted	118,220	5,911	2,400	75	3,000	210	123,620	6,196
Dog, fresh	6,522,629	109,940	789,615	3,948			7,312,244	113,888
Dog, salted	22,302	446					22,302	446
Humpback, fresh	18,579,907	133,059					18,579,907	133,059
Humpback, salted	1,266,093	31,653					1,266,093	31,653
Silver, fresh	20,606,686	364,287	5,154,375	97,281	60,160	2,105	25,821,221	463,673
Silver, salted	21,000	630					21,000	630
Steelhead	1,507,465	69,242	1,103,522	48,014	113,600	3,876	2,724,587	121,132
Salmon trout	44,000	3,080					44,000	3,080
Sardines					2,383,000	17,790	2,383,000	17,790
Sea bass, fresh	5,000	150			924,156	19,952	929,156	20,102
Sea bass, salted					14,000	540	14,000	540
Sea trout					50,068	1,459	50,068	1,459
Shad	85,000	1,275	32,000	320	1,137,801	14,303	1,254,801	15,898
Smelt	937,000	9,810	28,000	340	1,315,249	58,064	2,280,249	68,214
Striped bass					1,234,320	61,814	1,234,320	61,814
Sturgeon	89,685	3,907			205,659	11,426	295,344	15,333
Split-tail					131,926	2,639	131,926	2,639
Sculpin					3,000	75	3,000	75
Sole					32,245	645	32,245	645
Surf-fish					116,290	2,576	116,290	2,576
Tomcod					375,538	6,882	375,538	6,882
White-fish					58,010	1,169	58,010	1,169
Yellow-fin					24,000	480	24,000	480
Yellow-tail, fresh					75,544	1,513	75,544	1,513
Yellow-tail, salted					129,100	5,164	129,100	5,164
Abalone meat					369,411	22,813	369,411	22,813
Abalone shells					525,453	9,743	525,453	9,743
Clams	[a] 3,131,325	23,248	[b] 979,290	9,434	[c] 2,170,934	31,045	[d] 6,281,549	63,727
Oysters, Eastern					[e] 25,200,000	792,000	[l] 25,200,000	792,000
Oysters, native	[e] 5,901,320	174,567	[f] 59,100	1,625	[g] 3,600,000	75,000	[h] 9,560,420	251,192
Mussels	19,200	240			364,076	3,637	383,276	3,877
Crabs	274,696	11,119	110,604	2,615	3,676,680	85,784	4,061,980	99,518
Spiny lobsters					606,713	14,198	606,713	14,198
Shrimp, dried					698,625	69,862	698,625	69,862
Shrimp in shell	19,600	1,960			903,375	36,135	922,975	38,095
Shrimp shells					2,445,186	4,889	2,445,186	4,889
Squid, dried					622,740	18,682	622,740	18,682
Frogs					20,687	20,638	20,687	20,638
Terrapin					107,869	10,376	107,869	10,376
Whalebone					207,392	436,272	207,392	436,272
Whale oil	[i] 15,000	300			[j] 507,300	20,191	[k] 522,300	20,491
Sea-lion oil			750	35	5,250	210	6,000	245
Sea-lion pelts			18,000	720	13,000	612	31,000	1,332
Sea-lion trimmings				135		315		450
Sea lions, alive					[m] 7,880	920	[m] 7,880	920
Sea-otter pelts						1,000		1,000
Scallops					3,939	738	3,939	738
Algæ					35,824	896	35,824	896
Crawfish			116,400	7,760			116,400	7,760
Fur-seal pelts	375	1,000					375	1,000
Other products					104,396	5,417	104,396	5,417
Total	120,587,726	2,871,438	22,818,411	855,750	74,559,019	2,551,451	217,965,156	6,278,639

[a] 48,174 bushels.
[b] 15,066 bushels.
[c] 32,529 bushels.
[d] 95,769 bushels.
[e] 98,355 bushels.
[f] 985 bushels.
[g] 60,000 bushels.
[h] 159,340 bushels.
[i] 2,000 gallons.
[j] 67,628 gallons.
[k] 69,628 gallons.
[l] 360,000 bushels.
[m] 49 sea lions, alive.

FISHERIES OF WASHINGTON.

The remarkable growth in the fisheries of Washington between 1895 and 1899 has probably never been exceeded in so short a time in any section of the country. The capital invested has increased from $2,024,469 to $6,601,243, the value of products to the producer from $1,402,433 to $2,871,438, and the employees from 6,212 to 9,911. By far the largest portion of this increase has been in the catch and canning of salmon, the increase in canneries being from 17 in 1895 to 28 in 1899, the new canneries having more than double the capacity of the former ones. The halibut fishery has increased from 1,714,315 pounds in 1895 to 6,860,640 pounds in 1899, and the oyster fishery, in value of products, from $109,232 to $174,567. With the exception of the now prohibited fur-seal fishery, all branches of the fishing business have been prosperous and show a gain in products, the aggregate gain in pounds being from 59,079,527 in 1895 to 120,587,726 in 1899; and this large increase has been met by a constant demand, at prices encouraging to the producer and reasonable for the consumer.



STEELHEAD (*Salmo gairdneri*).

The three following tables show the apparatus and capital, the number of persons employed, and the products of the fisheries of the State of Washington in 1899:

Table of apparatus and capital.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	32	$72,400	Apparatus—shore fisheries—continued.		
Tonnage	880		Reef nets	20	$600
Outfit		44,715	Dip nets	55	140
Vessels transporting	72	275,200	Crab pots	574	685
Tonnage	1,222		Wheels	29	66,300
Outfit		86,314	Spears	88	255
Boats	2,566	233,475	Lines—trawl and hand		638
Pile-drivers	30	63,283	Harpoons		675
Apparatus—vessel fisheries:			Dredges, tongs, rakes, etc		3,453
Dredges	1	100	Shore and accessory property		1,200,892
Lines, trawl and hand		5,780	Cash capital		2,779,977
Apparatus—shore fisheries:					
Seines	205	93,420	Total		6,601,243
Gill nets	1,900	119,591			
Pound nets	540	1,552,650			
Fyke nets	70	700			

Table of persons employed.

How engaged.	No.
On vessels fishing	243
On vessels transporting	301
In shore fisheries	5,073
On shore, in canneries, etc	4,294
Total	9,911

Table of products.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Black cod	163,500	$4,475	Salmon—continued.		
Cat-fish	105,700	2,114	Silver, fresh	20,606,686	$364,287
Cod, salted	930,000	23,250	Silver, salted	21,000	630
Cultus-cod	91,000	1,530	Steelhead	1,507,465	69,242
Flounders	28,000	560	Salmon trout	44,000	3,080
Halibut	6,860,640	191,220	Sea bass	5,000	150
Herring	424,000	2,820	Shad	85,000	1,275
Perch	43,000	770	Smelt	937,000	9,810
Rock-fish	72,000	1,440	Sturgeon	89,685	3,907
Salmon:			Oysters	*5,901,320	174,567
Blueback, fresh	41,931,194	1,307,514	Clams	†3,131,325	23,248
Blueback, salted	70,000	2,801	Mussels	19,200	240
Chinook, fresh	10,702,189	387,120	Crabs	274,696	11,119
Chinook, salted	118,220	5,911	Shrimp	19,600	1,960
Dog, fresh	6,522,629	109,940	Fur-seal pelts	375	1,000
Dog, salted	22,302	446	Whale oil	15,000	300
Humpback, fresh	18,579,907	133,059			
Humpback, salted	1,266,093	31,653	Total	120,587,726	2,871,438

*98,355 bushels. †48,174 bushels.

COUNTIES AND FISHING WATERS.

The State of Washington is much favored in its numerous waterways of both fresh and salt water. Throughout the interior there are many small streams and lakes of considerable size, well supplied with trout and other fine fish. Some of these waters are favorite resorts for sportsmen, while many are isolated and seldom visited, except by the few natives residing in the vicinity.

The commercial fisheries up to the present time have been confined to fishing in 19 of the 34 counties of the State. These 19 counties border the Pacific or its arms that are near the coast, the Washington side of the Columbia River being the only exception, and on that stream the bulk of the fishing has been near the coast.

With the decline in the salmon fisheries of the Columbia River more attention has been given to the waters of the northwestern portion of the State, whose fisheries show a remarkable growth within the past few years. These waters, which in 1899 produced nearly one-third of the salmon catch of the world, are generally known as Puget Sound, although this also embraces Admiralty Inlet and portions of the Straits of Juan de Fuca and of the Gulf of Georgia. Although the salmon is by far the most important, many other species of fish are taken all through the year, forming important items in the fish products of the State.

Besides the waters of the State already noticed those of and near Grays Harbor and Willapa Bay have for years furnished a large supply of salmon to canners and the fresh-fish market. Just outside of the harbors, along the coast bordering Chehalis and Pacific counties, fine food-fish of numerous species are known to be abundant, but as yet are unsought by fishermen.

The business of 1899 is here shown by counties, giving the persons employed, capital invested, products in pounds, and their value to the fishermen, together with the amounts taken by the various appliances.

Table showing, by counties, the number of persons employed in the fisheries of Washington in 1899.

Counties.	On vessels fishing.	On vessels transporting.	In shore fisheries.	On shore, in canneries, etc.	Total.
Chehalis	.....	3	260	50	313
Clallam	.....	14	236	145	395
Clarke	.....	.....	38	.....	38
Cowlitz	.....	2	211	.....	213
Island	.....	.....	31	.....	31
Jefferson	24	.....	31	.....	55
King	136	33	724	401	1,294
Kitsap	3	.....	61	.....	64
Klickitat	.....	.....	16	.....	16
Mason	.....	.....	41	.....	41
Pacific	.....	24	867	162	1,053
Pierce	59	.....	262	41	362
San Juan	.....	.....	216	225	441
Skagit	21	37	262	656	976
Skamania	.....	.....	71	2	73
Snohomish	.....	.....	64	.....	64
Thurston	.....	.....	87	39	126
Wahkiakum	.....	9	587	205	801
Whatcom	.....	179	1,008	2,368	3,555
Total	243	301	5,073	1,294	9,911

Table showing, by counties, the vessels, boats, apparatus, and property employed in the fisheries of Washington in 1899.

Counties.	Vessels fishing.				Vessels transporting.				Boats.		Pile-drivers.	
	No.	Tonnage.	Value.	Value of outfit.	No.	Tonnage.	Value.	Value of outfit.	No.	Value.	No.	Value.
Chehalis	....	.....	.....	.....	1	9	$2,500	$200	170	$6,730	....	.....
Clallam	....	.....	.....	.....	2	23	13,500	3,200	176	7,920	....	.....
Clarke	....	.....	.....	.....	.....	.....	.....	.....	17	825	....	.....
Cowlitz	....	.....	.....	.....	1	5	1,000	200	117	9,455	....	.....
Jefferson	3	72	$8,000	$4,740	....	.....	.....	.....	4	120	....	.....
King	23	582	39,800	19,960	8	187	35,400	16,450	196	28,490	....	.....
Kitsap	1	12	400	380	....	.....	.....	.....	30	1,500	....	.....
Klickitat	....	.....	.....	.....	.....	.....	.....	.....	4	100	....	.....
Mason	....	.....	.....	.....	.....	.....	.....	.....	32	640	....	.....
Pacific	....	.....	.....	.....	12	81	6,800	.....	596	44,520	5	$5,000
Pierce	4	81	19,200	17,920	....	.....	.....	.....	96	4,590	....	.....
San Juan	....	.....	.....	.....	.....	.....	.....	.....	70	13,420	....	.....
Skagit	1	112	5,000	1,715	7	191	40,000	11,889	228	18,855	7	15,083
Skamania	....	.....	.....	.....	.....	.....	.....	.....	16	620	....	.....
Snohomish	....	.....	.....	.....	.....	.....	.....	.....	45	900	....	.....
Thurston	....	.....	.....	.....	.....	.....	.....	.....	42	840	....	.....
Wahkiakum	....	.....	.....	.....	2	44	8,000	.....	242	29,745	....	.....
Whatcom	....	.....	.....	.....	39	682	168,000	54,375	485	64,205	18	43,200
Total	32	889	72,400	44,715	72	1,222	275,200	86,314	2,566	233,475	30	63,283

Table showing, by counties, the vessels, boats, apparatus, and property employed in the fisheries of Washington in 1899—Continued.

Counties.	Apparatus—vessel fisheries.		Apparatus—shore fisheries.								
	Dredges.		Value of lines, trawl and hand.	Seines.			Gill nets.			Pound nets.	
	No.	Value.		No.	Length, feet.	Value.	No.	Length, feet.	Value.	No.	Value.
Chehalis							201	75,729	$11,854	5	$2,500
Clallam				17	11,760	$4,965	2	3,600	500	1	3,000
Clarke				2	2,400	800	3	3,600	600		
Cowlitz				3	3,600	1,200	86	61,080	9,800	29	14,500
Island										6	33,000
Jefferson			$800	16	3,060	875				1	10,000
King	1	$100	3,570	78	89,040	48,250	78	88,440	8,782	1	3,200
Kitsap			100							4	12,500
Klickitat							1	360	30		
Pacific				6	4,800	1,600	108	79,020	8,000	340	228,750
Pierce			1,250	30	22,800	8,100	73	12,840	1,945	1	10,000
San Juan										36	347,500
Skagit			60	17	13,850	8,580	650	155,400	21,225	3	15,000
Skamania							21	14,920	3,120	2	800
Snohomish							362	29,499	3,685		
Wahkiakum				15	23,700	5,850	193	298,200	45,850	29	19,400
Whatcom				21	17,580	13,200	122	34,299	4,200	82	852,500
Total	1	100	5,780	205	192,590	93,420	1,900	856,987	119,591	540	1,552,650

Counties.	Apparatus—shore fisheries—continued.											
	Fyke nets.		Reef nets.		Dip nets.		Crab pots.		Fish-wheels.		Spears.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Chehalis							30	$45			80	$240
Clallam							520	520			3	5
Clarke	60	$600							1	$500		
Cowlitz	10	100			25	$38						
Klickitat					18	90			8	11,900		
Skagit											5	10
Skamania									20	53,900		
Whatcom			20	$600	12	12	24	120				
Total	70	700	20	600	55	140	574	685	29	66,300	88	255

Counties.	Value of dredges, tongs, rakes, hoes, etc.	Value of lines, hand and trawl.	Value of harpoons.	Value of shore and accessory property.	Cash capital.	Total investment.
Chehalis		$20		$10,800	$30,000	$64,889
Clallam	$80	398	$675	43,000	65,000	142,763
Clarke				1,175		4,500
Cowlitz				2,500		38,793
Island						33,000
Jefferson	9	15		200		24,759
King				222,000	327,000	753,002
Kitsap	50					14,930
Klickitat		30				12,150
Mason	105					745
Pacific	2,995			53,100	134,000	484,765
Pierce	74	150		22,500	45,000	130,729
San Juan				30,000	50,000	440,920
Skagit	20	5		144,414	373,500	655,356
Skamania		20				58,460
Snohomish				900		5,485
Thurston	120			11,678	11,300	23,938
Wahkiakum				99,675	145,000	353,520
Whatcom				558,950	1,599,177	3,358,539
Total	3,453	638	675	1,200,892	2,779,977	6,601,243

Table showing, by counties and species, the yield of the fisheries of Washington in 1899.

Species.	Chehalis.		Clallam.		Clarke.		Cowlitz.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black-cod			30,000	$600				
Cat-fish					90,600	$1,812	15,100	$302
Cultus-cod			37,000	700				
Halibut			341,640	4,340				
Herring			4,000	20				
Rock-fish			5,000	100				
Salmon:								
Blueback, fresh			360,455	15,543	29,244	877	29,000	1,160
Chinook, fresh	913,205	$16,438	10,000	300	69,380	3,071	121,481	5,499
Dog, fresh	486,374	2,021	98,756	944				
Humpback, fresh			502,275	2,265				
Silver, fresh	1,866,797	28,860	595,993	9,634	317	9	137,005	4,105
Steelhead	242,000	10,183			11,318	348	63,239	2,704
Shad							60,000	900
Smelt			2,000	40			482,000	2,410
Sturgeon	24,000	900						
Clams			484,500	2,288				
Crabs	5,376	224	182,920	8,495				
Fur-seal pelts*	375	1,000						
Whale oil			15,000	300				
Total	3,538,127	59,626	2,669,539	45,569	200,859	6,117	907,825	17,080

Species.	Island.		Jefferson.		King.		Kitsap.		Klickitat.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black-cod			25,000	$750	66,500	$2,115	1,000	$30		
Cod, salted					550,000	13,750				
Cultus-cod			4,000	80						
Flounders					20,000	400				
Halibut			733,000	17,115	3,346,000	81,165	75,000	1,875		
Herring			50,000	500	30,000	600				
Perch					25,000	500				
Rock-fish					10,000	200				
Salmon:										
Blueback, fresh	979,730	$29,440	211,171	6,378	3,869,000	149,820			10,296	$309
Blueback, salted	2,056	82	1,920	77						
Chinook, fresh	651,721	13,271	21,658	676	39,560	1,342			75,973	3,039
Chinook, salted	4,920	246	3,950	198						
Dog, fresh	16,092	360	12,482	314	2,959,351	64,804	405,079	4,238		
Dog, salted	2,100	42								
Humpback, fresh	595,942	3,043	150,195	808	680,000	3,700				
Humpback, salted	37,230	931	32,940	824						
Silver, fresh	110,593	1,879	47,361	917	7,704,952	116,772	616,000	9,240	8,500	255
Steelhead	2,412	121	2,150	107	218,000	11,260			16,414	493
Smelt			3,000	60	70,000	1,500				
Sturgeon					13,333	500			44,078	1,905
Clams			18,000	75			1,924,800	15,540		
Mussels							19,200	240		
Shrimp					15,600	1,560				
Total	2,402,796	49,415	1,316,827	28,879	19,617,296	449,988	3,041,079	31,163	155,261	6,001

Species.	Skamania.		Snohomish.		Thurston.		Wahkiakum.		Whatcom.	
	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Herring									140,000	$700
Salmon:										
Blueback, fresh	532,600	$19,083					115,169	$4,155	25,536,434	768,110
Blueback, salted									45,320	1,813
Chinook, fresh	722,614	34,301	53,009	$1,150			2,544,961	127,247	1,430,383	31,161
Chinook, salted									75,900	3,795
Dog, fresh	5,426	27	24,930	226			146,050	979	493,974	9,352
Dog, salted									14,602	292
Humpback, fresh			8,632	43					11,392,913	91,940
Humpback, salted									819,060	20,476
Silver, fresh	9,357	234	701,480	11,817			470,098	16,453	2,935,535	49,775
Silver, salted									16,500	495
Steelhead	168,161	5,049	89,118	3,397			70,824	2,125	67,986	3,325
Shad							25,000	375		
Smelt							20,000	100	20,000	200
Sturgeon	7,554	586	720	16						
Oysters					1,680,000	$45,500			120,000	4,500
Clams					306,000	2,040				
Crabs									86,400	2,400
Total	1,445,712	59,280	877,889	16,649	1,986,000	47,540	3,392,102	151,434	43,195,007	988,334

*125 seals.

Table showing the yield of the fisheries of Washington in 1899—Continued.

Species.	Mason.		Pacific.		Pierce.		San Juan.		Skagit.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black-cod					41,000	$980				
Cod, salted									380,000	$9,500
Cultus-cod					50,000	750				
Flounders					8,000	160				
Halibut					2,365,000	86,725				
Herring					200,000	1,000				
Perch					18,000	270				
Rock-fish					57,000	1,140				
Salmon:										
Blueback, fresh			424,610	$16,045	1,415,080	42,503	7,544,052	$227,861	874,353	26,230
Blueback, salted					2,164	87	18,540	742		
Chinook, fresh			2,728,392	121,717	18,800	598	401,052	9,310	900,000	18,000
Chinook, salted					2,400	120	31,050	1,552		
Dog, fresh			723,056	3,616	674,574	14,745	226,575	4,065	249,910	4,249
Dog, salted							5,600	112		
Humpback, fresh					498,461	2,563	4,102,400	24,752	649,089	3,945
Humpback, salted					41,793	1,045	335,070	8,377		
Silver, fresh			1,843,848	45,910	1,301,590	32,418	1,087,432	18,462	1,169,828	17,547
Silver, salted							4,500	135		
Steelhead			503,469	27,512	2,666	133	21,708	1,085	28,000	1,400
Salmon trout					44,000	3,080				
Sea bass					5,000	150				
Smelt					100,000	2,500			240,000	3,000
Oysters	1,276,320	$34,567	2,825,000	90,000						
Clams	103,500	660			180,000	1,500			114,525	1,145
Shrimp					4,000	400				
Total	1,379,820	35,227	9,048,375	304,800	7,029,528	192,867	13,777,979	296,453	4,605,705	85,016

Table showing, by counties, species, and apparatus, the yield of the vessel fisheries of Washington in 1899.

Apparatus and species.	Jefferson.		King.		Kitsap.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Lines:						
Black-cod	25,000	$750	66,500	$2,115	1,000	$30
Cod, salted			550,000	13,750		
Halibut	725,000	16,875	3,346,000	81,165	75,000	1,875
Rock-fish			10,000	200		
Total	750,000	17,625	3,972,500	97,230	76,000	1,905
Dredges:						
Shrimp			15,600	1,560		
Grand total	750,000	17,625	3,988,100	98,790	76,000	1,905

Apparatus and species.	Pierce.		Skagit.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Lines:						
Black-cod	16,000	$480			108,500	$3,375
Cod, salted			380,000	$9,500	930,000	23,250
Halibut	2,365,000	86,725			6,511,000	186,640
Rock-fish	7,000	140			17,000	340
Total	2,388,000	87,345	380,000	9,500	7,566,500	213,605
Dredges:						
Shrimp					15,600	1,560
Grand total	2,388,000	87,345	380,000	9,500	7,582,100	215,165

Table showing, by counties, species, and apparatus, the yield of the shore fisheries of Washington in 1899.

Apparatus and species.	Chehalis.		Clallam.		Clarke.		Cowlitz.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Herring			4,000	$20				
Salmon:								
Blueback			293,050	12,925	17,244	$517	10,000	$400
Chinook					42,713	1,871	46,000	2,300
Dog			97,750	935				
Humpback			376,150	1,670				
Silver			415,838	7,237	317	9	10,000	300
Steelhead					5,518	166	24,730	989
Shad							25,000	375
Smelt			2,000	40				
Total			1,188,788	22,827	65,792	2,563	115,730	4,364
Gill nets:								
Salmon:								
Blueback			6,680	306	12,000	360	7,000	280
Chinook	883,205	$15,898			20,000	900	18,000	900
Dog	461,374	1,917						
Silver	1,691,797	26,154						
Steelhead	192,000	9,183			800	32	10,000	400
Shad							35,000	525
Sturgeon	24,000	900						
Total	3,252,376	54,052	6,680	306	32,800	1,292	70,000	2,105
Pound nets:								
Salmon:								
Blueback, fresh			60,725	2,312			12,000	480
Chinook, fresh	30,000	540	5,000	100			57,481	2,299
Dog, fresh	25,000	104	1,006	9				
Humpback, fresh			126,125	595				
Silver, fresh	175,000	2,706	36,047	596			127,005	3,805
Steelhead							28,509	1,315
Total	230,000	3,350	228,903	3,612			224,995	7,899
Fyke nets:								
Cat-fish					90,600	1,812	15,100	302
Lines, trawl and hand:								
Black-cod			30,000	600				
Cultus-cod			37,000	700				
Halibut			341,640	4,340				
Rock-fish			5,000	100				
Salmon:								
Silver			144,108	1,801				
Steelhead	50,000	1,000						
Total	50,000	1,000	557,748	7,541				
Wheels:								
Salmon:								
Chinook					6,667	300		
Steelhead					5,000	150		
Total					11,667	450		
Crab pots and dip nets:								
Smelt							482,000	2,410
Crabs	5,376	224	182,920	8,495				
Harpoons and spears:								
Salmon, chinook			5,000	200				
Fur-seal pelts	375	1,000						
Whale oil			15,000	300				
Total	375	1,000	20,000	500				
Dredges, tongs, rakes, etc.:								
Clams			484,500	2,288				
Grand total	3,538,127	59,626	2,669,539	45,569	200,859	6,117	907,825	17,080

Table showing, by counties, species, and apparatus, the yield of the shore fisheries of Washington in 1899—Continued.

Apparatus and species.	Island.		Jefferson.		King.		Kitsap.		Klickitat.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:										
Flounders					20,000	$400				
Herring			50,000	$500	30,000	600				
Perch					25,000	500				
Salmon:										
Blueback					2,669,000	107,576				
Chinook			4,000	80	22,060	467				
Dog			2,000	20	2,425,151	51,863				
Humpback			10,000	50	680,000	3,700				
Silver			6,000	90	6,305,952	95,337				
Smelt			3,000	60	70,000	1,500				
Sturgeon					13,333	500				
Total			75,000	800	12,260,496	262,443				
Gill nets:										
Salmon:										
Blueback					1,200,000	42,244				
Chinook					17,500	875			200	$8
Dog					414,200	9,941				
Silver					1,314,000	20,160				
Steelhead					218,000	11,260			400	12
Total					3,163,700	84,480			600	20
Pound nets:										
Salmon:										
Blueback, fresh	979,730	$29,440	211,171	6,378						
Blueback, salted	2,056	82	1,920	77						
Chinook, fresh	651,721	13,271	17,658	596						
Chinook, salted	4,920	246	3,950	198						
Dog, fresh	16,092	360	10,482	294	120,000	3,000	405,079	$4,238		
Dog, salted	2,100	42								
Humpback, fresh	595,942	3,043	140,195	758						
Humpback, salted	37,230	931	32,940	824						
Silver, fresh	110,593	1,879	41,361	827	85,000	1,275	616,000	9,240		
Steelhead	2,412	121	2,150	107						
Total	2,402,796	49,415	461,827	10,059	205,000	4,275	1,021,079	13,478		
Lines, trawl and hand:										
Cultus-cod			4,000	80						
Halibut			8,000	240						
Sturgeon									44,078	1,905
Total			12,000	320					44,078	1,905
Wheels:										
Salmon:										
Blueback									10,296	309
Chinook									69,773	2,791
Silver									8,500	255
Steelhead									16,014	481
Total									104,583	3,836
Dip nets:										
Salmon, chinook									6,000	240
Dredges, tongs, rakes, etc.:										
Clams			18,000	75			1,924,800	15,540		
Mussels							19,200	240		
Total			18,000	75			1,944,000	15,780		
Grand total	2,402,796	49,415	566,827	11,254	15,629,196	351,198	2,965,079	29,258	155,261	6,001

Table showing, by counties, species, and apparatus, the yield of the shore fisheries of Washington in 1899—Continued.

Apparatus and species.	Mason.		Pacific.		Pierce.		San Juan.		Skagit.	
	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:										
Herring					200,000	$1,000				
Perch					18,000	270				
Salmon:										
Blueback					925,000	27,750			241,035	$7,231
Chinook			96,943	$2,672						
Dog			5,000	25	443,862	13,316			69,280	693
Humpback					355,000	1,775			310,055	1,550
Silver			135,173	2,028	628,000	15,700			318,500	4,777
Steelhead			23,631	945						
Trout					44,000	3,080				
Smelt					100,000	2,500			240,000	3,000
Total			260,747	5,670	2,713,862	65,391			1,178,870	17,251
Gill nets:										
Salmon:										
Blueback					275,000	8,250			43,803	1,314
Chinook			355,739	11,253					775,000	15,500
Dog			112,500	563	218,000	1,090			177,294	3,523
Humpback									88,019	1,140
Silver			201,090	3,249	638,000	15,950			627,618	9,414
Steelhead			121,616	7,581					28,000	1,400
Total			790,945	22,646	1,131,000	25,290			1,739,734	32,291
Pound nets:										
Salmon:										
Blueback, fresh			424,610	16,045	215,080	6,503	7,544,052	$227,861	589,515	17,685
Blueback, salted					2,164	87	18,540	742		
Chinook, fresh			2,275,710	107,792	18,800	598	401,052	9,310	110,000	2,200
Chinook, salted					2,400	120	31,050	1,552		
Dog, fresh			605,556	3,028	12,712	339	226,575	4,065	3,336	33
Dog, salted							5,600	112		
Humpback, fresh					143,461	788	4,102,400	24,752	251,015	1,255
Humpback, salted					41,793	1,045	335,070	8,377		
Silver, fresh			1,507,585	40,633	35,590	768	1,087,432	18,462	205,710	3,086
Silver, salted							4,500	135		
Steelhead			358,222	18,986	2,666	133	21,708	1,085		
Total			5,171,683	186,484	474,666	10,381	13,777,979	296,453	1,159,576	24,259
Lines, trawl and hand:										
Black cod					25,000	500				
Cultus-cod					50,000	750				
Flounders					8,000	160				
Rock-fish					50,000	1,000				
Salmon, silver									18,000	270
Sea bass					5,000	150				
Total					138,000	2,560			18,000	270
Spears:										
Salmon, chinook									15,000	300
Dredges, tongs, rakes, etc.:										
Clams	103,500	$660			180,000	1,500			114,525	1,145
Oysters	1,276,320	34,567	2,825,000	90,000						
Shrimp					4,000	400				
Total	1,379,820	35,227	2,825,000	90,000	184,000	1,900			114,525	1,145
Grand total	1,379,820	35,227	9,048,375	304,800	4,641,528	105,522	13,777,979	296,453	4,225,705	75,516

Table showing, by counties, species, and apparatus, the yield of the shore fisheries of Washington in 1899—Continued.

	Skamania.		Snohomish.		Thurston.		Wahkiakum.		Whatcom.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:										
Herring									140,000	$700
Salmon:										
Blueback							115,169	$4,155	700,000	21,000
Chinook							911,567	45,577		
Dog							21,380	107	35,880	359
Silver							179,802	6,293	363,747	5,493
Steelhead							51,684	1,551		
Shad							25,000	375		
Smelt									20,000	200
Total							1,304,602	58,058	1,259,627	27,752
Gill nets:										
Salmon:										
Blueback	66,283	$1,988							807,068	24,713
Chinook	105,888	4,741	53,009	$1,150			1,616,258	80,813	267,808	5,569
Dog			24,930	226			30,830	154	6,360	76
Humpback			8,632	43					40,678	204
Silver			701,480	11,817			59,022	2,066	501,824	8,382
Steelhead	3,308	99	89,118	3,397			19,140	574	14,922	672
Smelt							20,000	100		
Sturgeon			720	16						
Total	175,479	6,828	877,889	16,649			1,745,250	83,707	1,638,660	39,616
Pound nets:										
Salmon:										
Blueback, fresh									23,729,366	712,397
Blueback, salt									45,320	1,813
Chinook, fresh	967	44					17,136	857	1,162,575	25,592
Chinook, salt									75,900	3,795
Dog, fresh	5,426	27					93,840	718	451,734	8,917
Dog, salted									14,602	292
Humpback, fresh									11,352,235	91,736
Humpback, salted									819,060	20,476
Silver, fresh	9,357	234					231,274	8,094	2,069,964	35,900
Silver, salted									16,500	495
Steelhead	3,513	105							53,064	2,653
Total	19,263	410					342,250	9,669	39,790,320	904,066
Reef nets:										
Salmon, blueback									300,000	10,000
Lines, trawl:										
Sturgeon	7,554	586								
Wheels:										
Salmon:										
Blueback	466,317	17,095								
Chinook	615,759	29,516								
Steelhead	161,340	4,845								
Total	1,243,416	51,456								
Crab pots:										
Crabs									86,400	2,400
Dredges, tongs, rakes, etc.:										
Clams					306,000	$2,040				
Oysters					1,680,000	45,500			120,000	4,500
Total					1,986,000	47,540			120,000	4,500
Grand total	1,445,712	59,280	877,889	16,649	1,986,000	47,540	3,392,102	151,434	43,195,007	988,334

Summary of the yield of the shore fisheries of Washington in 1899.

Apparatus and species.	Lbs.	Value.
Seines:		
Flounders	20,000	$400
Herring	424,000	2,820
Perch	43,000	770
Salmon:		
Blueback	4,970,498	181,554
Chinook	1,123,283	52,967
Dog	3,100,303	67,318
Humpback	1,731,205	8,745
Silver	8,363,329	137,264
Steelhead	105,563	3,651
Salmon trout	44,000	3,080
Shad	50,000	750
Smelt	435,000	7,300
Sturgeon	13,333	500
Total	20,423,514	467,119
Gill nets:		
Salmon:		
Blueback	2,417,834	79,455
Chinook	4,112,607	137,607
Dog	1,445,488	17,490
Humpback	137,329	1,387
Silver	5,734,831	97,192
Steelhead	697,304	34,610
Shad	35,000	525
Smelt	20,000	100
Sturgeon	24,720	916
Total	14,625,113	369,282
Pound nets:		
Salmon:		
Blueback, fresh	33,766,249	1,019,101
Blueback, salted	70,000	2,801
Chinook, fresh	4,748,100	163,199
Chinook, salted	118,220	5,911
Dog, fresh	1,976,838	25,132
Dog, salted	22,302	446
Humpback, fresh	16,711,373	122,927
Humpback, salted	1,266,093	31,653
Silver, fresh	6,337,918	127,505
Silver, salted	21,000	630
Steelhead	472,244	24,505
Total	65,510,337	1,523,810
Fyke nets:		
Cat-fish	105,700	2,114
Reef nets:		
Salmon, blueback	300,000	$10,000
Lines, trawl and hand:		
Black-cod	55,000	1,100
Cultus-cod	91,000	1,530
Flounders	8,000	160
Halibut	349,640	4,580
Rock-fish	55,000	1,100
Salmon:		
Silver	162,108	2,071
Steelhead	50,000	1,000
Sea bass	5,000	150
Sturgeon	51,632	2,491
Total	827,380	14,182
Wheels:		
Salmon:		
Blueback	476,613	17,404
Chinook	692,199	32,607
Silver	8,500	255
Steelhead	182,354	5,476
Total	1,359,666	55,742
Crab pots and dip nets:		
Salmon, chinook	6,000	240
Smelts	482,000	2,410
Crabs	274,696	11,119
Total	762,696	13,769
Harpoons and spears:		
Salmon, chinook	20,000	500
Fur-seal pelts	375	1,000
Whale oil	15,000	300
Total	35,375	1,800
Dredges, tongs, rakes, etc.:		
Clams	3,131,325	23,248
Oysters	5,901,320	174,567
Mussels	19,200	240
Shrimp	4,000	400
Total	9,055,845	198,455
Grand total	113,005,626	2,656,273

Whatcom County.—In 1899 this county, the northern boundary of which borders British Columbia, contained 11 of the largest salmon canneries of the State, producing 605,406 cases of salmon against 53,118 cases put up by the only two canneries of the county in 1895. Six of the canneries were located at or near Blaine, at the international boundary line, and five at Fairhaven. The waters of this vicinity appear to be quite well supplied with numerous species of fish other than salmon, to which scarcely any attention has yet been given.

Pound nets produce the principal part of the salmon catch of Whatcom and adjoining counties, and call for particular notice. Their general construction is similar to those in common use on the Atlantic coast and in the Great Lakes, but they are of larger size. The pot of the pound is nearly 40 feet square, the leaders from 500 to the legal limit of 2,500 feet in length. Galvanized wire is much used for lead-

ers, twine being used for the pots, the latter being in water from 20 to 78 feet deep at high tide. On an average 250 piles are required for a single pound. Eighty-two pound nets were used in the waters of Whatcom County in 1899, gill nets and seines being also used to some extent. Purse seines are operated considerably in this section by fishermen from Seattle and other places.

The blueback or sockeye salmon are peculiar in being much more numerous every fourth year. During 1899 the pound nets would often be filled during a single night's run of these fish. From 5,000 to 20,000 salmon were frequently taken from a single pound at one time. The result of one day's fishing from one pound, located near Point Roberts, was 22,000 salmon, of 132,000 pounds aggregate weight and $4,400 value.

Some of the largest firms have introduced steam pile-drivers, of a comparatively new pattern, which are built in Chicago and cost $6,000 each. One, owned at Fairhaven, was on a scow 23 by 65 feet, being 45 inches deep; the derrick, 70 feet high; the hammer, of 7,000 pounds, is attached to a small cylinder steam engine, that has its piston directly attached to the hammer. Steam is carried to the engine by a rubber hose that follows it up and down the derrick. The hammer gives a quick short blow just the length of the piston, by which the piles are much less liable to be damaged and are quicker placed than by the old-time drop hammer. Nine men comprise the working crew.

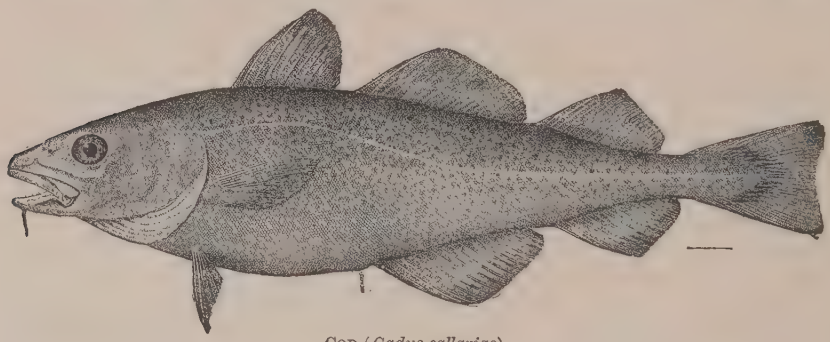
With the increasing demand for salmon the desirable locations for pound nets became of great importance, often forming the basis of small fortunes, and between 1889 and 1899 the rush for them was often exciting. Locations not already taken could be secured from the State by its citizens only, they paying $25 for an annual license, after which a numbered license was given that permitted the putting down of a pound net in any of the waters of the State not already occupied. The requisites to secure the location were the driving of a few piles on the spot selected and attaching on the same a conspicuously painted number of the license. In numerous cases license fees have been paid, a few piles have been placed and numbered, but the pound nets have not been put down. The State report of pounds licensed therefore often varies considerably from the number in actual use.

During 1898 and 1899 pound nets in the most desirable locations have changed hands at prices ranging as high as from $20,000 to $90,000 for single pounds, the original expense of which did not exceed $5,000. Five pounds, with fixtures and location, were reported as having been sold during 1899 at prices ranging from $35,000 to $90,000, the aggregate being $300,000. It is not probable that such high values will ever be realized again.

Fairhaven being near the valuable fishing waters of Whatcom County, and also having desirable rail and water shipping facilities, has of late come into fishery prominence. Previous to 1895 only a

limited amount of fresh fish was shipped from there, but since that date five salmon canneries have been built, their aggregate pack in 1899 being 329,428 cases. Some of these canneries are the largest on the coast, all having the latest improved appliances for the canning of fish and giving employment to 1,280 persons.

The plant of the Pacific American Fishery Company is of special note. It embraces 18 acres, of which 10 acres are occupied by two canneries, warehouses, offices, and other buildings. This double cannery has a ground floor area of 6 acres, the second story 2 acres. The buildings are lighted from their own electric plant and have all the latest labor-saving machines. The daily capacity is 7,500 cases of 48-pound cans of salmon. The largest amount packed in any one day during 1899 was 5,000 cases. The pack during the season amounted to 139,790 cases (representing over 9,000,000 pounds of fresh salmon), the largest amount on record from any of the canneries of the State.



Cod (*Gadus callarias*).

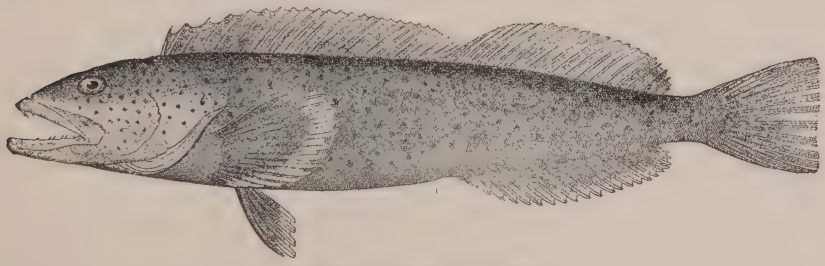
Some small beds of native oysters in Samish Bay, long known, but neglected, are now being improved and give favorable promise for the future. During 1899 2,000 bushels of oysters, worth $4,500, were disposed of locally by a few white men and Indians who gathered them by hand at low tide.

Skagit County.—The fisheries continue to increase in importance. The three large salmon canneries at Anacortes packed 172,232 cases during 1899. The fish for the same amounted to 12,053,823 pounds of salmon, gross weight. The waste from these canneries produced 350 tons of fertilizer and 22,000 gallons of salmon oil. Clams are more or less plentiful around the islands of Skagit and San Juan counties. From October to April is the clam season, during which time a few Indians work the beds and dispose of the clams at a small cannery at Anacortes. The pack of clams of 1899, all of which were the hard-shell species, amounted to 2,140 cases. The shells are shipped to Seattle, where they are sold for use in poultry yards.

The cod fishery is here represented by one vessel of 143 tons that landed 380,000 pounds of cod taken in Bering Sea. The cod are dried and prepared for market as boneless fish.

Skagit River furnishes one of the most important fisheries in the State, and except the Columbia River is practically the southern limit of migration of the valuable sockeye salmon. These fish in quite large numbers ascend the river to the distant cold waters of Baker Lake for spawning. They furnish a large amount of the catch and income of many fishermen residing near the river's outlet.

The fisheries of Skagit River and the immediate vicinity show some decrease both in products and fishermen since 1895. The pound nets outside the mouth of the river are reported as having an increased catch at the expense of the usual supply of the river. The catch of 1899 found a ready market at largely increased prices over those of a



CULTUS-COD (*Ophiodon elongatus*).

BLACK COD OR BESHOWE (*Anoplopoma fimbria*).

few years since, the fishermen having larger returns than formerly, when the catch was much larger and prices very low. Only gill nets are used in the river fisheries. Drift gill nets used in the river are 55 fathoms long and set gill nets 10 fathoms long. A few near the mouth of the river are each 125 fathoms in length, 20 meshes deep, of 9 and 10 inch mesh. A few Indians on the near-by reservation fish for the market, and many of them for their personal use, their catch being by the primitive yet effective spear.

The various runs of salmon in the Skagit River are as follows: Chinook, from the last of May up to the last of August; silver salmon, from the last of August to November; a few humpbacks are taken in August; dog salmon run from September to November 15; blueback, from the last of May to July 15, with their greatest abundance in June. But few bluebacks are taken, as their capture requires a smaller-meshed net than those generally used for larger species of salmon.

Steelheads are much scarcer than formerly. They are found as early as the middle of November, but not many before December, there being a scattering light run all winter.

La Connor, at the mouth of the river, continues to be the headquarters for the river fishermen. Here supplies are purchased and the fish are sold to agents of fresh-fish firms and canneries.

The prices and average weights of fish in 1899 were as follows:

Salmon.	Price.	Pounds.
Steelhead	5 cents per pound	11
Chinook	2 cents per pound	20
Humpback	3 cents each	4
Dog	6 cents each	15
Blueback	20 cents each	6½
Silver	13 cents each	8

The catch from the Skagit River during 1899 amounted to 1,652,320 pounds of salmon, that brought the fishermen $30,997, and 240,000 pounds of smelt, of $3,000 value. No pound nets are permitted to be used in the river.

San Juan County comprises a group of rugged islands between Skagit County and the southern end of Vancouver Island. Through the numerous waterways of these islands the immense numbers of salmon pass in their migration toward the Fraser River and other streams northward, and here are located many pound nets owned by the canneries of Whatcom County. One cannery at Friday Harbor, a branch of one at Fairhaven, packed 20,549 cases of salmon, of which 14,908 were blueback. The total amount of salmon used at the cannery was 1,359,620 pounds gross weight, all caught by pound nets.

Snohomish County.—The fisheries are confined to the salmon catch of the Snohomish River. The few miles of river from Everett, at its mouth, to Snohomish City comprise the fishing-grounds, from which 607,169 pounds of salmon were taken in 1899. Five-sixths of this amount was silver salmon, the remainder comprising, with the exception of the blueback, all the other species of salmon. Sturgeon are occasionally taken in the salmon nets, but here as elsewhere in the numerous rivers of the coast these valuable fish have been nearly exterminated. The catch of this stream is bought by agents of Seattle canners and fresh-fish firms.

King County.—The fisheries of this county are practically the fisheries of Seattle. The continued large increase in the fish business of that city is shown by the following receipts from the home fishermen:

Year.	Pounds.	Value.
1892	2,385,352	$72,300
1895	11,469,118	123,582
1899	19,601,545	448,428

The products comprised 15,470,712 pounds of salmon, 3,346,000 pounds of halibut, 234,833 pounds of other species of fresh fish, and 550,000 pounds of salted cod. This catch, with the exception of cod and part of the halibut, was made in the waters of the State by 893 fishermen of King County, fishing through the waters of Puget Sound.

The investment in vessels, boats, fishing apparatus and shore property in the county amounted to $204,002, which amount, with a cash capital of $549,000, makes a total of $753,002 invested in the fisheries of King County. The two canneries at Seattle put up 91,500 cases of salmon, valued at $344,225, using 6,105,938 pounds of fish, gross weight. Seattle is also a market for fishery products from other sections of the State. The wholesale dealers handle most of the fish fresh. In 1899 they shipped 10,418,908 pounds, to which may be added 752,852 pounds of salted fish. The oysters, crabs, clams, shrimp, and mussels handled represented $85,265 in value.

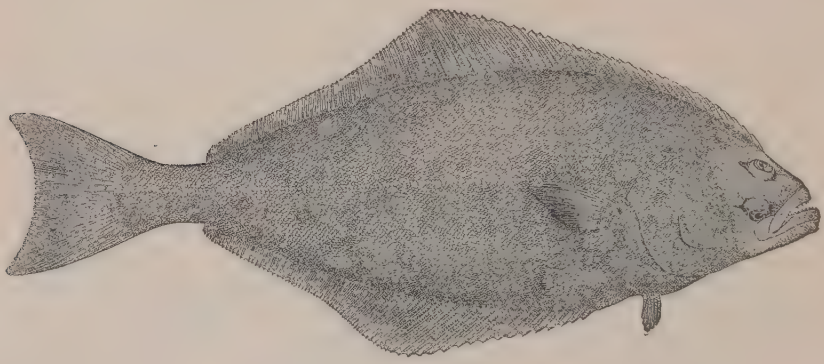
STARRY OR CALIFORNIA FLOUNDER (*Paralichthys stellatus*).

The increase in salmon and halibut taken by the home fisheries since 1895 was as follows:

Species.	1895.	1899.
	Pounds.	*Pounds.*
Salmon	3,994,650	15,470,712
Halibut	790,000	3,346,000

Considerable quantities of salmon, halibut, and herring were smoked, and this business slowly increases. The products show a great improvement in quality, and will compare favorably with those of any section of the country. Some Seattle firms have establishments in Alaska where the salting of salmon is largely carried on, the salted fish finding a growing market in the Eastern States and in Japan.

The halibut fishery by fishermen of Kings County has grown to considerable importance by an increased number of small-sized vessels of only a few tons burden, with from two to five men each, a few having larger crews. These little craft follow the business all through the year. From April to October the catch is largely from grounds inside and outside of the Straits of Juan de Fuca in the vicinity of Cape Flattery, with less amounts from the waters of Puget Sound. After October the larger vessels leave for Alaska, fishing through the winter near Wrangell Narrows, shipping their catch to Seattle, up to April, by local steamers. The halibut fishermen seldom save any other fishes, although several species of good food-fish are plentiful all through these waters. Even halibut prices of 2 to 3 cents a pound are very low when compared with those paid to fishermen of the Atlantic coast.



THE HALIBUT (*Hippoglossus hippoglossus*).

The wholesale fish trade of Seattle in 1899 was represented by nine establishments, valued at $148,000, and with a cash capital of $152,000. The persons employed numbered 159 and received $74,622 in wages. The following table gives the details of this trade:

	Lbs.	Value.
Fresh fish sold:		
Black cod	96,100	$4,808
Cultus-cod	70,000	2,630
Halibut	4,081,267	129,231
Herring	116,140	2,527
Flounders	24,200	956
Perch	46,030	1,842
Rock-fish	17,000	850
Salmon:		
Chinook	877,400	44,022
Silver	1,982,000	85,460
Dog	1,485,700	50,971
Humpback	471,50[illegible]	12,322
Steelhead	472,80	37,824
Smelt	270,4[illegible]	9,130
Sturgeon	16,89[illegible]	551
Trout, salmon	10,500	1,312
Trout, brook	110	27
Total	10,038,087	384,463
Pickled and smoked fish:		
Cod, salted	422,500	$18,100
Halibut, salted	1,800	72
Herring, pickled	205,000	4,200
Salmon, pickled	1,123,400	33,082
Halibut, smoked	111,848	7,895
Herring, smoked	33,534	1,005
Salmon, smoked	208,680	10,450
Total	2,106,762	74,804
Miscellaneous:		
Crabs	208,752	12,712
Clams	533,400	6,750
Oysters	1,338,970	50,120
Oysters	105,300	22,230
Shrimp	15,600	2,340
Total	2,202,022	94,152
Grand total	14,346,871	553,419

Kitsap County.—The fisheries are prosecuted by about 40 Indians, who furnish the Seattle market with clams and mussels, taken almost within sight of the city. They receive $1 per sack of 125 pounds, or about 50 cents per bushel. Only hard-shell clams are found.

Pierce County.—The fisheries of this county are of some importance, being represented by three small vessels, one steamer of 78 tons, and 96 small boats, 321 fishermen, and 41 shore employees, the capital invested amounting to $130,729. The products included 6,845,528 pounds of fish of $190,967 value to the fisherman, and $1,900 worth of clams and shrimp.

Of the fish receipts 2,365,000 pounds were halibut and 3,957,528 pounds salmon. The remainder consisted of smelt, herring, rock, cultus-cod, flounders, and a few other species. Shipments of fresh halibut to the east of the Rocky Mountains amounted to 1,811,000 pounds. The remainder, after supplying the home demand at Tacoma, was distributed to numerous points throughout the interior.

The steamer mentioned is engaged exclusively in the halibut fishery in Alaskan waters, making headquarters and shipping to eastern points from Tacoma.

Shrimp are taken near Anderson Island at the southern end of Puget Sound, by the use of drag nets.

The fisheries of the county center at Tacoma, which has also one fish cannery that put up a general assortment of prepared fish, including salmon, canned and in oil, clams and clam chowder, smoked salmon, herring, and halibut; also smoked herring in olive oil in 1-pound tins, marinated and deviled herring in glass packages, Russian sardines in 15-pound pails, and salt herring in barrels.

There were two wholesale fish establishments at Tacoma in 1899, valued at $17,000, and with a capital of $38,000. They employed 27 persons, who received $10,000 in wages. The quantities and value of the products handled in that year by these establishments are shown by the following table:

Products.	Lbs.	Value.	Products.	Lbs.	Value.
Black cod, fresh	12,000	$610	Salmon:		
Black cod, salted	1,000	280	Chinook, fresh	70,000	$4,700
Bass, fresh	5,000	450	Silver, fresh	300,000	14,000
Cat-fish, fresh	2,000	120	Dog, fresh	300,000	14,750
Cultus-cod, fresh	9,000	340	Dog, smoked	100,000	3,500
Flounders, fresh	6,000	120	Humpback, fresh	325,000	5,500
Herring, fresh	125,000	2,375	Steelhead, fresh	27,000	2,390
Herring, salted	10,000	250	Trout, brook, fresh	1,000	120
Halibut, fresh	2,410,000	84,350	Trout, salmon, fresh	44,000	4,320
Halibut, salted	204,000	8,200	Clams	169,000	1,830
Perch, fresh	13,000	400	Crabs	12,000	750
Rock-fish, fresh	30,000	1,350	Shrimp	4,000	500
Smelt, fresh	70,000	2,900			
Sturgeon, fresh	4,000	400	Total	4,298,000	155,705
Salmon, salt	42,000	1,200			

Mason and Thurston counties.—These two counties are at the extreme southern end of Puget Sound. Their fisheries yield among other things the small Puget Sound oysters, and Hoods Canal, in Mason County, at times furnishes salmon in considerable quantities. The oyster business of this section, formerly of considerable importance, has been reduced from overfishing, with little or no care of the beds, so that the products of the two counties in 1895 amounted to only $17,132 in value. During that year legislative action, disposing of lands suitable for oyster culture and protecting the same, led to an increase of size and improvement in quality of the oysters with a large increase in the yield, which in 1899 amounted to 29,636 sacks, or 49,272 bushels, of $80,067 value.

The oyster-grounds are located in Oyster Bay, which produces the largest amount, and Mud Bay, Oakland, or Shelton Bay, Swindels Cove, North and South bays, all being in Mason and Thurston counties. The products are marketed chiefly at Olympia. The oyster and clam business gave employment to 128 men, and yielded 6,825 bushels of clams of $2,700 value. A small cannery at Olympia made a limited pack of clams and fish.

In 1899 there were five establishments at Olympia handling oysters and clams. Their fixtures, machinery, etc., were valued at $11,575, and their cash capital was $11,300. They employed 39 people, who received $8,600 in wages.

The following table shows the products handled and their value:

Products.	Lbs.	Value.
Oysters, bushels, 9,000	540,000	$16,444
Oysters, gallons, 15,400	107,800	29,260
Clams, bushels, 4,415	286,975	3,800
Clams, canned, dozens, 1,220	25,296	14,640
Clam nectar, dozens, 400	9,600	500
Total	969,671	64,644

Clallam County.—This county, at the entrance to the Strait of Juan de Fuca, and the northwestern extremity of the State, has important halibut and salmon fisheries, together with fisheries by Indians at Neah Bay, a salmon cannery at Port Angeles, and the crab fisheries of Dungeness. The Indians, in 1899, caught, by trolling with spoon hook, 15,926 silver salmon, which they disposed of to canneries at 10 cents each. They continue to use canoes and paddles in all their fisheries, and also in pursuing whales, 12 of the latter being taken during 1899. The largest part of the whale is cut up into strips for drying, and, with smoked halibut and salmon, forms a large portion of their winter's food supply. These Indians were formerly quite largely interested in the fur-seal fisheries, and had a number of sealing vessels, in which they followed the seals northward to Bering Sea. As this is now prohibited, they have disposed of their vessels.

The harbor of Port Angeles is one of the best on the Pacific coast. Fish are plentiful in the vicinity, and the place will no doubt have more important fisheries in the future. The cannery here, in 1899, packed 29,124 cases of salmon and 2,000 cases of clams and clam nectar of $116,428 value; 2,038,680 pounds of salmon, gross weight, and 4,370 bushels of clams were used at the cannery. The clams were bought at 30 cents a bushel from the Indians of Port Williams.

New Dungeness and the adjoining Port Williams have important crab fisheries, the catch being made in the harbors of these two places with pots similar to those used in New England for lobsters. The pots are baited with clams and refuse fish and anchored in about 3 fathoms of water. This fishery is followed more or less all through the year, the catch being made chiefly during the winter and spring, the summer demand being light. The catch by fishermen of New Dungeness amounted to 135,480 pounds of $6,435 value, and from Port William 37,440 pounds of $1,794 value.

Crabs are reported to be of average abundance from year to year, notwithstanding the large amount taken from a small area of fishing-grounds. The catch as soon as landed is packed alive in large boxes holding 10 dozen each. The average weight of the crabs was 2 pounds each; the average price received by the fishermen, $1.15 per dozen. The crabs are shipped by steamer to Seattle and are distributed all through the Northwest and as far south as San Francisco.

The quantity of fish taken in Clallam County since 1895 does not vary so much in amount as in value, showing that the fishermen have received a decided gain during a more prosperous condition of the country, the comparison being as follows:

Items.	1895.		1899.	
	Lbs.	Value.	Lbs.	Value.
Fish	2,065,025	$17,879	1,987,119	$34,486
Crabs	121,520	3,256	182,920	8,495

Jefferson County.—The fisheries center at Port Townsend, supplying that city, the surplus finding a market at Seattle. Fish of numerous varieties are reported plentiful in this vicinity and the fisheries are quite likely to show an increase in the future. In 1899 the few fishermen of the county marketed 1,316,827 pounds of fish of $28,879 value, as against 912,435 pounds of $16,724 value in 1895.

Chehalis County.—The fisheries of this county are limited to the salmon catch from the Chehalis River and near its outlet. Just outside the river's mouth many species, including smelt, herring, flounders, rock-fish, perch, and bastard halibut are plentiful. As they are within quick reach of the large fresh-fish markets of Seattle and Portland, these grounds will probably at an early day contribute materially to the income of the fishermen.

The salmon catch of 1899 was mostly taken by gill nets used in the river near its outlet. As compared with 1895, it shows quite an increase, the gross weight and value to the fishermen being as follows:

Year.	Lbs.	Value.
1895	1,971,357	$35,135
1899	3,508,376	57,502

One salmon cannery packed 24,240 cases, of which 15,740 were silver salmon, 5,000 chinook, and 3,500 chum or dog salmon. Shipments fresh amounted to 1,811,576 pounds as against 1,115,390 pounds in 1895. The persons employed were 260 fishermen and 50 shore employees, and the capital amounted to $64,889. Aberdeen, at the head of Grays Harbor, is the chief shipping-point, less fishery business being done at Cosmopolis and Hoquiam.

The Indians of the Quinaiult Reservation take salmon from the river, most of the catch being used on the reservation. 56,257 pounds, of $1,297 value, were sold to the fish agents at Aberdeen in 1899. The Indians also captured the only fur seals taken on the coast, spearing from their canoes 125 seals, for which they received $1,000.

Pacific County.—Salmon and oysters are the only species of importance in this county at present. The capital, employees, and products of the fisheries in 1895, as compared with those of 1899, were as follows:

Items.	1895.	1899.
Capital invested	$448,020	$484,765
First value of fish	186,031	214,800
First value of oysters	92,100	90,000
Fishermen	583	891
Shore employees	246	162

The salmon product of 1899 from the Columbia River and Willapa Bay and its tributaries was as follows:

Species.	Lbs.	Value.
Chinook	2,728,392	$121,717
Silver	1,843,848	45,910
Dog	723,056	3,616
Blueback	424,610	16,045
Steelhead	503,469	27,512
Total	6,223,375	214,800

This large amount of salmon was sold at higher prices than ever before received. The fishermen reaped the benefit of the competition between the canners and cold-storage fresh-fish firms. Three canneries were operated on Willapa Bay and its tributaries, and one on the Columbia River. The single cannery on the Columbia River packed 15,000 cases, of $83,425 value, and the three canneries on Willapa Bay,

21,314 cases, of $79,176 value. A large portion of the catch went to the fresh-fish firms.

The oyster business, from lack of proper care of the beds, shows a steady decrease, only 45,000 sacks having been shipped in 1899, as against 78,825 sacks in 1892 and 61,400 sacks in 1895. The sacks contain about 1½ bushels each and weigh about 85 pounds. With a growing scarcity of oysters, sacks are somewhat smaller and prices have advanced from $1.50 a sack in 1895 to $2 a sack in 1899. The business in native oysters is confined to Willapa Bay. Eastern oysters of full size, planted here experimentally by the U. S. Fish Commission, have been found to grow well, but there are as yet no evidences as to their propagation in these waters. It is understood that oysters from Eastern seed are now being grown in Willapa Bay, after the manner practiced in California, where seed oysters are brought annually from the Atlantic coast and laid in favorable localities in San Francisco Bay for further growth.

Wahkiakum County.—The fisheries of this county are practically limited to its salmon catch from the Columbia River, which forms its boundary on the south. During 1899 four canneries were operated, packing 60,868 cases of salmon, of $313,345 value. The capital invested in the fisheries of the county amounted to $353,520, the fishermen numbered 596, and the shore employees 205. The gross weights of fish caught and values to the fishermen were as follows: Salmon, 3,347,102 pounds, $150,959; shad, 25,000 pounds, $375; smelts, 20,000 pounds, $100. The shad and smelt were taken from seines used in the salmon fishery, which often contain more shad than salmon.

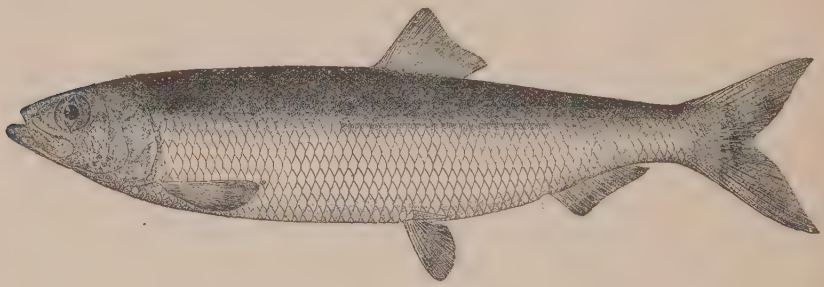
Shad are not fished for specially and bring so low a price that they are sometimes used as fertilizer, but oftener thrown back into the river. They are usually first taken about the middle of April, being most abundant up to the middle of June. The first sent to the Portland market in 1899 brought 8 cents each, at which price they were saved. As their number increased prices dropped to 2 or 3 cents, or about one-half cent a pound, and as that barely covered the freight and expenses, leaving nothing to the fishermen, the shipments stopped. Shad are of large size and fine quality. A few which were canned as an experiment retained their fine flavor, and were much improved by the entire disappearance of bones from the action of the excessive heat in cooking. The canning of shad may yet form an important factor in the fisheries of the Columbia River.

Of the salmon pack of 1,200 cases, 84,000 pounds of silver and dog salmon were from Grays Harbor, the remainder of the pack being Columbia River fish.

Cowlitz County.—Of late years the fisheries of this county have decreased in importance. The catch is from the Columbia and Cowlitz rivers. The aggregate amount in 1899 was 907,825 pounds, of $17,080 value, composed of 350,725 pounds of salmon, 482,000 pounds

of smelt, 60,000 pounds of shad, and 15,100 pounds of cat-fish. Of this amount 300,000 pounds went to the canneries of the river, the remainder to cold-storage and fresh-fish firms. The smelt catch is made with dip nets in the Cowlitz River, the fishermen receiving prices that average only one-half cent a pound.

Skamania County.—Twenty salmon fish-wheels in this county in 1899 caught 1,243,416 pounds of salmon, valued at $51,456. Twenty-one gill nets caught 175,479 pounds of salmon, and two small pound nets took 19,263 pounds of salmon, the aggregate being 1,438,158 pounds of salmon, of $58,694 value. The catch of 1895 amounted to 1,484,723 pounds of salmon. During 1895 the sturgeon catch was considerable, being 1,177,106 pounds, against 7,554 pounds in 1899. The capital invested during 1899 amounted to $58,460; the fishermen numbered 71.



PACIFIC HERRING (*Clupea pallasi*).

Clarke County.—The fisheries here are maintained by a few fishermen of Vancouver, who fish in the Columbia River, the catch of salmon and cat-fish being marketed at Portland.

Klickitat County. This county is bordered on the south for nearly 150 miles by the Columbia River. The fisheries receive but little attention. Near the western end of the county eight fish-wheels were operated with indifferent results. A few Indians used dip nets and a few hooks were employed for sturgeon. The total catch amounted to only 111,183 pounds of salmon and 44,078 pounds of sturgeon.

The fishing beyond this section, higher up on the Columbia, is by the ranchers or Indians living near the stream, their small catch being for their own use.

FISHERIES OF OREGON.

The seven counties forming the western boundary of Oregon border on the Pacific for some 300 miles. Along this long stretch of ocean front are many fine fishing-grounds that are yet to be utilized; some are near shipping-points and none are far removed from good markets.

Up to the present time the fisheries of the State have been limited almost exclusively to salmon taken from near the outlets of the numerous rivers which flow into the Pacific. These streams drain many lakes of the interior, more or less supplied with trout and other fish. Some of the more accessible lakes are resorts for sportsmen. In most of the rivers the salmon catch shows a decrease when compared with previous investigations, the decrease in many cases being due to excessive fishing.

The capital invested, persons employed, and value of products in 1895 and 1899 are here shown:

Items.	1895.	1899.	Salmon canned.	1895.	1899.
Capital invested	$2,637,412	$3,497,643	Cases	525,839	341,297
First value of products	1,282,036	855,750	Value	$2,456,698	$1,704,235
Employees	6,323	5,643			

The decrease in the amount of salmon canned is accounted for, in part, by the large quantities used fresh or pickled. Nearly all of the coast rivers show a decrease in the amount of salmon canned, the largest decrease being in that of the Columbia River.

The following tables give the statistics of the fisheries in 1899:

Table of persons employed.

How engaged.	No.
On vessels fishing	10
On vessels transporting	65
In shore fisheries	3,731
On shore, in canneries, etc	1,837
Total	5,643

Table of apparatus and capital.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	1	$6,000	Apparatus—shore fisheries:		
Tonnage	59		Wheels	47	$121,300
Outfit		335	Fyke nets	36	360
Vessels transporting	30	66,300	Hoop nets	2,325	1,829
Tonnage	330		Crab pots	80	80
Outfit		4,490	Dip nets	12	60
Boats	1,830	198,240	Guns	4	100
Apparatus—vessel fisheries:			Tongs, rakes, hoes, etc		191
Lines, trawl		400	Shore and accessory property		1,174,148
Apparatus—shore fisheries:			Cash capital		1,561,000
Gill nets	2,067	297,700			
Seines	46	19,910	Total		3,497,643
Pound nets	65	45,200			

Table of products.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Cat-fish	54,360	$1,087	Perch	6,360	$95
Flounders	3,522	53	Shad	32,000	320
Halibut	17,000	1,360	Smelt	28,000	340
Herring	19,120	347	Oysters (985 bushels)	59,100	1,625
Salmon:			Clams (15,066 bushels)	979,290	9,434
Blueback	579,183	21,293	Crabs	110,604	2,615
Chinook, fresh	13,744,810	659,213	Crawfish	116,400	7,760
Chinook, salted	2,400	75	Sea-lion pelts	18,000	720
Dog	789,615	3,948	Sea-lion oil	750	35
Silver	5,154,375	97,281	Sea-lion trimmings		135
Steelhead	1,103,522	48,014	Total	22,818,411	855,750

COLUMBIA RIVER FISHERIES.

The fisheries of the Columbia River are here exhibited in tables which show the total number of cases of salmon canned from 1866 to 1899 and the quantity of salmon frozen at the cold-storage plants during 1899. The Columbia being bordered by Washington and Oregon, the fishery tables are here given for the river, the amount credited to each State being included in the tables showing the products by counties and States.

The commercial fisheries of the Columbia may be dated from 1866, in which year the first salmon cannery on the river opened the business with a pack of 4,000 cases. In the thirty-four years since that date, or from 1866 to and including 1899, the total amount of salmon canned on this stream amounted to 13,111,110 cases of 48 pounds each, or 629,333,280 pounds of canned salmon, of $73,346,465 value. The table showing the pack of each year is interesting for reference. The small amount packed the first two years sold at an average of $16 a case, the highest prices ever received. During the next three years the price fell to $12 per case, and between 1871 and 1875 a constantly increased catch ranged from $10.50 down to $6. The next five years prices ranged from $5.50 to $5. The lowest prices ever known were $4.50 in 1881, the prices remaining between $4.50 and $5 from 1881 to 1886. During the past thirteen years prices have ranged between $5, the lowest, and $6.25 in 1888, the highest. The values given are for the chinook salmon, which is of world-wide reputation and was for many years the only species packed. Of late years the fall run of silver salmon has received more attention.

The largest pack in any year was in 1895, when 634,696 cases were packed; the smallest since 1889 was that of 328,174 cases in 1899, a decrease of nearly 50 per cent from the extra large pack of 1895. A comparison between these two years is as follows:

Items.	1895.	1899.
	Lbs.	*Lbs.*
Salmon used at canneries	41,706,001	21,503,326
Salmon sold fresh and frozen	4,699,657	2,448,608
Salmon pickled		1,546,756
Total	46,405,658	25,498,690

The salmon catch of the Columbia River has been decreasing during the past few years. For many years the river has been overfished, and the quantity of fishing apparatus has been constantly increasing. During 1899 3,944 fishermen and 1,447 shoresmen were employed. The fishing apparatus consisted of 444 pound nets, 1,356 gill nets, 32 haul seines, and 76 fish-wheels.

Aside from salmon, the fisheries of the Columbia are at present of small value and receive but little attention.

Summary of the salmon-canning industry of the Columbia River, in Oregon and Washington, between 1866 and 1899.

Year.	Cases.	Value.	Year.	Cases.	Value.	Year.	Cases.	Value.
1866....	4,000	$64,000	1878....	460,000	$2,300,000	1890.....	435,774	$2,407,456
1867....	18,000	288,000	1879....	480,000	2,640,000	1891.....	398,953	2,240,964
1868....	28,000	392,000	1880....	530,000	2,650,000	1892.....	487,328	2,679,096
1869....	100,000	1,350,000	1881....	550,000	2,475,000	1893.....	415,877	2,107,500
1870....	150,000	1,800,000	1882....	541,300	2,600,000	1894.....	505,987	2,651,940
1871....	200,000	2,100,000	1883....	629,400	3,147,000	1895.....	634,696	3,342,298
1872....	250,000	2,325,000	1884....	620,000	2,915,000	1896.....	463,777	2,261,826
1873....	250,000	2,250,000	1885....	553,800	2,500,000	1897.....	552,721	2,219,311
1874....	350,000	2,625,000	1886....	448,500	2,135,000	1898.....	481,461	2,087,748
1875....	375,000	2,250,000	1887....	356,000	2,124,000	1899.....	328,174	1,753,525
1876....	450,000	2,475,000	1888....	372,477	2,327,981			
1877....	380,000	2,052,000	1889....	309,885	1,809,820	Total ..	13,111,110	73,346,465

Shad appear to be constantly increasing, many tons being taken in the haul seines used in the salmon fishery, but only a few are saved, the demand being very light and prices so low that fishermen prefer to throw them back into the river or use them for fertilizer. The shad will probably become a valuable addition to the products of the river, as the demand from fresh-fish dealers continually increases.

The cold-storage fish business is represented by four firms, located at Portland, Goble, and Astoria, representing $265,000 capital, with 81 employees. Two of the cold-storage plants, used exclusively for fish, have the latest improved machinery and are large and noticeable for their cleanness and attractive appearance.

The shipments of fresh salmon to points east of the Rocky Mountains began in a small way during 1890 and the business soon became important. It finally extended to Europe, large quantities of fresh frozen salmon being sent to Hamburg and from there distributed over the Continent. This has been followed by a growing business in pickled slack-salted salmon for smoking, of which 1,308,494 pounds net weight were shipped to Europe from the cold-storage establishments of the Columbia River during 1899. The chinook salmon only were used in supplying the foreign demand for pickled salmon, a large-size fat fish being desired for smoking.

In the preparation of the fish, they are split on the under side and eviscerated, and the head, fins, tail, and backbone are removed. The dressed fish, after a thorough washing, are well salted and packed in tierces, the first few being placed back down, others back up, with layers of salt between. After the casks are filled pickle is added. The

packed casks average 800 pounds of salmon. The fish, being only slack-salted, are at once placed in cold storage until wanted for shipment, and are then sent in refrigerator cars to New York and in the cold-storage rooms of steamers to Europe. The demand for large-size pickled salmon for Europe began about 1896, since which time it has yearly increased. The constantly increasing demand for fresh frozen and pickled salmon from the Columbia River has to some extent reduced the output of canned salmon and led to sharp competition between the canners and cold-storage firms, resulting in the fishermen receiving much higher prices than ever before.

In 1899 four establishments, valued at $120,000, and with a cash capital of $145,000, were engaged in cold-storage fish business on the Columbia River in Oregon. Their employees numbered 77. The products and their value are shown by the following table:

Items.	Lbs.	Value.
Salmon:		
Silver, frozen	866,905	$44,584
Chinook, frozen	39,966	1,998
Dog, frozen	117,739	4,710
Steelhead, frozen	897,534	78,594
Chinook, pickled	1,308,494	145,852
otal salmon	3,230,638	275,738
Sturgeon, frozen	38,725	3,873
Caviar	1,587	1,191
Grand total	3,270,950	280,802

STATISTICS OF OREGON BY COUNTIES.

The following tables show the fisheries of Oregon for 1899 by counties, and give in detail the persons employed, capital invested, products by species, and first value of same, and the catch by each form of apparatus. The general decrease in the fisheries of late years is due chiefly to a lighter catch of salmon as compared with former years.

Table showing, by counties, the number of persons employed in the fisheries of Oregon in 1899.

Counties.	On vessels fishing.	On vessels transporting.	In shore fisheries.	On shore, in canneries, fish-houses, etc.	Total.
Clackamas			106		106
Clatsop	10	39	2,224	1,197	3,470
Columbia			162	12	174
Coos		4	318	105	427
Curry		3	53	59	115
Douglas		3	204	50	257
Lane		8	87	46	141
Lincoln			234	101	335
Multnomah		8	177	170	355
Tillamook			106	48	154
Wasco			36	49	85
Washington			14		14
Yamhill			10		10
Total	10	65	3,731	1,837	5,643

Table showing, by counties, the vessels, boats, apparatus, and other property employed in the fisheries of Oregon in 1899.

Counties.	Vessels fishing.				Vessels transporting.				Boats.	
	No.	Tonnage.	Value.	Value of outfit.	No.	Tonnage.	Value.	Value of outfit.	No.	Value.
Clackamas									51	$1,005
Clatsop	1	59	$6,000	$335	22	207	$34,300	$2,450	1,121	164,905
Columbia									82	7,650
Coos					1	8	3,500	240	149	5,900
Curry					1	19	4,000	100	29	1,275
Douglas					1	18	4,000	300	105	5,350
Lane					2	43	13,500	400	38	975
Lincoln									136	4,200
Multnomah					3	35	7,000	1,000	53	1,895
Tillamook									53	4,925
Wasco									1	40
Washington									7	70
Yamhill									5	50
Total	1	59	6,000	335	30	330	66,300	4,490	1,830	198,240

Counties.	Gill nets.			Seines.			Pound nets.		Wheels.	
	No.	Length, feet.	Value.	No.	Length, feet.	Value.	No.	Value.	No.	Value.
Clackamas	68	18,000	$2,505						2	$1,500
Clatsop	1,057	986,500	224,525	28	17,910	$13,900	48	$35,300		
Columbia	98	77,640	12,940				8	5,600		
Coos	235	126,150	15,275	4	3,600	1,000				
Curry	94	25,320	3,590	3	2,160	600				
Douglas	162	105,930	17,655				1	500		
Lane	80	45,600	7,600	1	1,200	400				
Lincoln	145	58,440	5,925	2	1,500	360				
Multnomah	40	18,720	3,010	4	6,000	2,000	8	3,800	20	49,800
Tillamook	88	76,200	4,675							
Wasco				4	3,000	1,650			25	70,000
Total	2,067	1,538,500	297,700	46	35,370	19,910	65	45,200	47	121,300

Counties.	Fyke nets.		Hoop nets.		Crab pots.		Dip nets.		Guns.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Clackamas			875	$655						
Clatsop					80	$80				
Columbia	6	$60	100	75						
Curry									4	$100
Lincoln			350	350						
Multnomah	30	300	375	281						
Wasco							12	$60		
Washington			375	281						
Yamhill			250	187						
Total	36	360	2,325	1,829	80	80	12	60	4	100

Counties.	Value of tongs, rakes, hoes, etc.	Lines, trawl (on vessels).	Shore and accessory property.	Cash capital.	Total investment.
Clackamas			$1,100		$6,765
Clatsop	$63	$100	843,268	$1,258,000	2,583,526
Columbia			41,400	50,000	117,725
Coos			21,225	34,000	81,140
Curry			35,180	15,000	59,845
Douglas			22,300	16,000	66,105
Lane			13,100	12,000	47,975
Lincoln	128		26,200	26,000	63,163
Multnomah			69,875	105,000	243,961
Tillamook			31,400	30,000	71,000
Wasco			69,100	15,000	155,850
Washington					351
Yamhill					237
Total	191	400	1,174,148	1,561,000	3,497,643

Table showing, by species and counties, the yield of the fisheries of Oregon in 1899.

Species.	Clackamas.		Clatsop.		Columbia.		Coos.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Cat-fish					9,060	$181		
Halibut*			17,000	$1,360				
Herring			12,000	240				
Salmon:								
Blueback			130,760	5,184	18,600	744		
Chinook, fresh	81,550	$4,078	10,630,342	552,947	505,146	25,257	161,860	$3,445
Dog			261,796	1,308				
Silver	16,500	495	1,276,577	34,107	18,507	555	890,680	13,937
Steelhead	52,870	2,643	665,338	33,300	9,400	400		
Shad			30,000	300				
Smelt			28,000	340				
Clams			951,510	9,087				
Crabs			31,341	980				
Crawfish	63,000	4,200			5,400	360		
Total	213,920	11,416	14,034,667	639,153	566,113	27,497	1,052,540	17,382

Species.	Curry.		Douglas.		Lane.		Lincoln.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Flounders							3,522	$53
Herring							7,120	107
Perch							6,360	95
Salmon:								
Chinook, fresh	356,265	$3,563	64,750	$1,943	158,040	$2,766	380,577	6,114
Chinook, salted	2,400	75						
Dog			8,050	41	8,050	40	105,000	525
Silver	113,425	1,134	530,320	10,606	615,610	9,234	922,117	12,277
Steelhead			32,500	1,625			18,034	721
Oysters							59,100	1,625
Clams							27,780	347
Crabs							79,260	1,635
Sea-lion pelts	18,000	720						
Sea-lion oil	750	35						
Sea-lion trimmings		135						
Total	490,840	5,662	635,620	14,215	781,700	12,040	1,608,870	23,499

Species	Multnomah.		Tillamook.		Wasco.		Washington.		Yamhill.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Cat-fish	45,300	$906								
Salmon:										
Blueback	391,996	13,880			37,827	$1,485				
Chinook, fresh	927,146	44,714	261,330	$3,788	217,804	10,598				
Dog	12,339	62	394,380	1,972						
Silver	28,980	1,101	603,815	9,747	137,844	4,088				
Steelhead	252,120	7,095	17,000	340	56,260	1,890				
Shad	2,000	20								
Crawfish	15,000	1,000					15,000	$1,000	18,000	$1,200
Total	1,674,881	68,778	1,276,525	15,847	449,735	18,061	15,000	1,000	18,000	1,200

*Taken in the vessel fisheries.

Table showing, by counties, apparatus of capture, and species, the yield of the fisheries of Oregon in 1899.

Apparatus and species.	Clackamas.		Clatsop.		Columbia.		Coos.		Curry.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:										
Salmon:										
Blueback					9,000	$360				
Chinook	59,400	$2,970	9,746,278	$489,346	451,226	22,561	153,960	$3,283	356,265	$3,563
Dog			204,160	1,020						
Silver	16,500	495	1,103,565	28,914	18,507	555	795,480	12,223		
Steelhead	29,700	1,485	314,022	15,735	7,000	280				
Smelt			20,000	100						
Total	105,600	4,950	11,388,025	535,115	485,733	23,756	949,440	15,506	356,265	3,563
Seines:										
Herring			12,000	240						
Salmon:										
Blueback			77,448	3,052						
Chinook, fresh			601,604	49,178			7,900	162		
Chinook, salted									2,400	75
Dog			7,000	35						
Silver			22,000	730			95,200	1,714	113,425	1,134
Steelhead			252,656	12,632						
Shad			30,000	300						
Smelt			8,000	240						
Total			1,010,708	66,407			103,100	1,876	115,825	1,209
Pound nets:										
Salmon:										
Blueback			53,312	2,132	9,600	384				
Chinook			282,460	14,423	53,920	2,696				
Dog			50,636	253						
Silver			151,012	4,463						
Steelhead			98,660	4,933	2,400	120				
Total			636,080	26,204	65,920	3,200				
Wheels:										
Salmon:										
Chinook	22,150	1,108								
Steelhead	23,170	1,158								
Total	45,320	2,266								
Fyke nets:										
Cat-fish					9,060	181				
Trawls:										
Halibut*			17,000	1,360						
Hoop nets:										
Crawfish	63,000	4,200			5,400	360				
Crab pots, dip nets and guns:										
Crabs			31,344	980						
Sea-lion pelts									18,000	720
Sea-lion oil									750	35
Sea-lion trimmings										135
Total			31,344	980					18,750	890
Tongs, hoes, etc.:										
Clams			951,510	9,087						
Grand total	213,920	11,416	14,034,667	639,153	566,113	27,497	1,052,540	17,382	490,840	5,662

Apparatus and species.	Douglas.		Lane.		Lincoln.		Multnomah.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets.								
Herring					7,120	$107		
Salmon.								
Blueback							52,504	$1,575
Chinook	54,690	$1,641	138,040	$2,416	342,952	5,693	114,217	5,219
Dog			8,050	40	105,000	525	510	3
Silver	495,350	9,907	555,610	8,334	834,442	11,364	5,598	167
Steelhead	32,500	1,625			18,034	721	29,769	1,101
Total	582,540	13,173	701,700	10,790	1,307,548	18,410	202,598	8,065

*Taken in the vessel fisheries.

Table showing, by counties, apparatus of capture, and species, the yield of the fisheries of Oregon in 1899—Continued.

Apparatus and species.	Douglas.		Lane.		Lincoln.		Multnomah.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Flounders					3,522	$53		
Perch					6,360	95		
Salmon:								
Blueback							94,055	$2,822
Chinook, fresh			20,000	$350	37,625	421	121,350	5,224
Dog							418	2
Silver			60,000	900	87,675	913	575	14
Steelhead							26,852	806
Total			80,000	1,250	135,182	1,482	243,250	8,868
Pound nets:								
Salmon:								
Chinook	10,060	$302					30,000	1,500
Dog	8,050	41					3,568	18
Silver	34,970	699					19,806	845
Steelhead							17,624	849
Total	53,080	1,042					70,998	3,212
Wheels:								
Salmon:								
Blueback							245,437	9,483
Chinook							661,579	32,771
Dog							7,843	39
Silver							3,001	75
Steelhead							177,875	4,339
Shad							2,000	20
Total							1,097,735	46,727
Fyke nets:								
Cat-fish							45,300	906
Hoop nets:								
Crabs					79,260	1,635		
Crawfish							15,000	1,000
Tongs, hoes, etc.:								
Clams					27,780	347		
Oysters					59,100	1,625		
Total					86,880	1,972		
Grand total	635,620	14,215	781,700	12,040	1,608,870	23,499	1,674,881	68,778

Apparatus and species.	Tillamook.		Wasco.		Washington.		Yamhill.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:								
Salmon:								
Chinook	261,330	$3,788						
Dog	394,380	1,972						
Silver	603,815	9,747						
Steelhead	17,000	340						
Total	1,276,525	15,847						
Seines:								
Salmon:								
Chinook, fresh			88	$4				
Silver			114,183	3,415				
Steelhead			478	14				
Total			114,749	3,433				
Wheels:								
Salmon:								
Blueback			37,827	1,485				
Chinook			205,716	10,114				
Silver			23,661	673				
Steelhead			55,782	1,876				
Total			322,986	14,148				
Hoop nets:								
Crawfish					15,000	$1,000	18,000	$1,200
Dip nets:								
Salmon, chinook			12,000	480				
Grand total	1,276,525	15,847	449,735	18,061	15,000	1,000	18,000	1,200

Summary, by apparatus, of the yield of the fisheries of Oregon in 1899.

Apparatus and species.	Lbs.	Value.
Gill nets:		
Herring	7,120	$107
Salmon:		
Blueback	61,504	1,935
Chinook	11,678,358	540,480
Dog	712,100	3,560
Silver	4,428,867	81,706
Steelhead	448,025	21,287
Smelt	20,000	100
Total	17,355,974	649,175
Seines:		
Flounders	3,522	53
Herring	12,000	240
Perch	6,360	95
Salmon:		
Blueback	171,503	5,874
Chinook, fresh	788,567	55,339
Chinook, salted	2,400	75
Dog	7,418	37
Silver	493,058	8,820
Steelhead	279,986	13,452
Shad	30,000	300
Smelt	8,000	240
Total	1,802,814	84,525
Pound nets:		
Salmon:		
Blueback	62,912	2,516
Chinook	376,440	18,921
Dog	62,254	312
Silver	205,788	6,007
Steelhead	118,684	5,902
Total	826,078	33,658
Wheels:		
Salmon:		
Blueback	283,264	$10,968
Chinook	889,445	43,993
Dog	7,843	39
Silver	26,662	748
Steelhead	256,827	7,373
Shad	2,000	20
Total	1,466,041	63,141
Fyke nets:		
Cat-fish	54,360	1,087
Trawls:		
Halibut	17,000	1,360
Hoop nets:		
Crabs	79,260	1,635
Crawfish	116,400	7,760
Total	195,660	9,395
Crab pots, dip nets, guns:		
Crabs	31,344	980
Salmon, chinook	12,000	480
Sea-lion pelts	18,000	720
Sea-lion oil	750	35
Sea-lion trimmings		135
Total	62,094	2,350
Tongs, hoes, etc.:		
Clams	979,290	9,434
Oysters	59,100	1,625
Total	1,038,390	11,059
Grand total	22,818,411	855,750

Clatsop County.—This county has many natural advantages for the prosecution of the fisheries. Located at the outlet of the Columbia River, and bounded on the west by the Pacific Ocean, it is near valuable fishing grounds, with rail and water facilities for shipment. For many years the business, which centered at Astoria, was almost exclusively based on the salmon. Before the Alaska salmon fisheries were developed Astoria was the headquarters of the canned-salmon business of the United States. Of late years the industry has declined with the catch of salmon, although capital has been freely used and an increased quantity of apparatus employed in the endeavor to regain the former amount of business.

The following tables show the capital and products of Clatsop County for 1899 as compared with those of 1895:

Items.	1895.	1899.
Capital	$1,809,100	$2,583,526
Value of products	$1,040,480	$639,153
Employees	3,908	3,470

The following shows the Clatsop County fishery products and their first value:

Species.	1895.		1899.	
	Lbs.	Value.	Lbs.	Value.
Salmon	26,548,262	$1,027,132	12,964,813	$626,846
Smelt	31,125	1,245	28,000	340
Shad	35,000	350	30,000	300
Herring			12,000	240
Halibut			17,000	1,360
Sturgeon	56,380	1,446		
Crabs	23,520	637	31,344	980
Clams	234,500	2,010	951,510	9,087
Crawfish	2,800	160		
Seals		7,500		
Total	26,931,587	1,040,480	14,034,667	639,153

The cases of salmon packed were as follows:

Year.	No. of canneries.	Cases.	Value.
1895	11	387,013	$1,917,073
1899	9	206,889	1,128,905

Two small fish scrap and oil establishments at Astoria collect the refuse from some of the canneries. These plants represent $43,200 capital, employing 35 men, and in 1899 produced 19,600 gallons of salmon oil of $4,130 value, and 140 tons of fish scrap for fertilizer, valued at $3,000. Only a small portion of the refuse from the canneries of the river has ever been saved.

A small proportion of the salmon cans used are hand-made at the canneries, but most of them are made at large factories. The can factory at Astoria represents $350,000 capital, and employs 125 persons. During 1899 the factory used 60,000 cases of tin plate, all of domestic make. Twenty-two million salmon cans were made in 8 sizes and 16 varieties. A large stock of cans is kept on hand to supply orders from the canneries of Oregon, Washington, and Alaska.

Clams and crabs are quite plentiful along the beaches of Clatsop County near the mouth of the Columbia. Since the jetties were built some 4 miles of beach have been made connecting with 13 miles of the old beach, on which razor clams are plentiful. A few soft-shell clams had previously been found on the old beaches, and clams are reported as rapidly increasing near the jetties.

The razor clams canned, are minced, cooked, and packed in their own liquor. They have been much in demand, being shipped as far east as Chicago. During 1899, 7,143 bushels of clams were used at the cannery and 6,450 bushels were shipped in the shell; the 13,593 bushels giving the 25 clam diggers $9,087. Five thousand cases of canned clams, of $27,750 value, were marketed.

Crabs taken from the same beaches numbered 1,306 dozen, or 31,344 pounds, valued at $980.

Columbia County.—The fisheries of this county are confined almost exclusively to the salmon catch from the Columbia, of which 551,653 pounds were taken in 1899, against 923,268 pounds in 1895. The fisheries of the county were also reduced by the prohibition of sturgeon fishing, the catch of which in 1895 amounted to 762,027 pounds. The total value of the products in 1895 amounted to $50,150, and in 1899 to $27,497, all of which went to canneries and fresh-fish dealers.

Multnomah County.—The fisheries of this county center at Portland, where there is a large amount of capital invested in salmon canneries located in Alaska, Washington, and Oregon. There were only two canneries in operation in Multnomah County in 1899. The fisheries of the county in 1899 amounted to 1,674,881 pounds, of $68,778 value, with $243,961 capital invested and 355 fishermen and shore employees engaged. The two canneries packed 44,757 cases of salmon, valued at $228,237. The products of the fisheries of the county are almost exclusively salmon from the Columbia River.

The wholesale fresh-fish business of Portland yearly increases, the receipts being from Oregon and Washington, with a limited amount from California. The distributions have a wide range, covering a large home and surrounding country demand, with quite large shipments of frozen and pickled salmon to the Atlantic and European markets. This branch of the fisheries represents $182,500 capital, with 50 employees. The sales for 1899 amounted to 3,332,141 pounds, of $254,976 value, as follows:

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Black cod, fresh	29,172	$1,605	Halibut, smoked	2,926	$234
Black bass, fresh	1,575	157	Herring, smoked	8,305	1,496
Cat-fish, fresh	77,678	4,929	Herring, salted	19,000	755
Carp, fresh	30,000	450	Salmon, smoked	24,014	1,921
Flounders, fresh	25,784	1,284	Salmon, salted	522,311	48,231
Halibut, fresh	378,001	18,900	Crawfish	117,696	19,556
Herring, fresh	31,860	1,276	Crabs	14,596	606
Perch, fresh	49,279	2,414	Shrimp	2,000	250
Rock-fish, fresh	2,000	80	Spiny lobsters	2,000	250
Salmon, fresh	1,578,096	91,569	Native oysters	.....	30,826
Shad, fresh	86,497	1,785	Eastern oysters	.....	3,237
Smelt, fresh	310,171	9,305	Clams	.....	12,600
Sturgeon, fresh	10,085	759			
Striped bass, fresh	933	93	Total	3,332,141	254,976
Tomcod, fresh	8,162	408			

The crawfish business has largely increased of late years, and forms quite an item in receipts at Portland, amounting to 39,232 dozen, or 117,696 pounds. The catch is made in the sloughs of the Columbia and its tributary streams between March and September. A large part of the catch is used at Portland, with a considerable demand from Seattle, Tacoma, San Francisco, and as far east as Salt Lake City and St. Louis. The average weight is 3 pounds to the dozen. As prepared for shipment the crawfish is placed alive in a preparation of white wine and spices and boiled for about ten minutes. The crawfish and the liquor in which it has been boiled are next packed in tin buckets holding from 2 to 3 dozen each.

Wasco County.—This county is bounded on the north by the Columbia River, and is between 200 and 300 miles from its mouth. Salmon were formerly very plentiful in this section, and the Indians largely resorted here for their winter supply of fish food. Later, canneries were established, and with the constantly increased apparatus within 100 miles of the mouth of the stream, the fish reaching Wasco County were much reduced in numbers. The total catch of salmon during 1899 amounted to only 449,735 pounds, of $18,061 value. The Indian catch, which is made by dip-nets, amounted to only 12,000 pounds. Nearly all of the catch was taken by fish wheels, 25 of which were used; many of them, not taking enough to pay expenses, were abandoned early in the season. The capital invested in wheels and other property, including two canneries, amounted to $155,850, and gave employment to 85 fishermen and canners. The two canneries packed only 7,610 cases of salmon, of $35,863 value.

The fish products of the county all came from the Columbia River, and comprised only salmon, most of which went to the canners, a small amount being sent to the fresh-fish markets.

The small amount of fishing in the Columbia River above Wasco County is limited to ranchers and Indians living near its shores, who fish occasionally for their own use.

Clackamas County.—In 1899 the products of the fisheries of this county consisted of 150,920 pounds of salmon, of $7,216 value, caught in the Willamette River, and 63,000 pounds of crawfish from its tributaries. The few miles of the river between Oregon City and Portland and a few miles between the latter and the entrance of the river into the Columbia comprise the fishing-grounds. The capital invested is small, being $6,765; 106 men follow the fisheries for a small portion of the year. The catch is sold locally and to the Portland market. Within this short reach of fishing-ground shad are said to spawn and at times are plentiful. Carp are also numerous, but neither of these species brings enough to induce the fishermen to save those found in their nets.

The falls of the river at Oregon City probably prevent the passing of fish, as there are no commercial fisheries above that point.

Tillamook County.—This county has many small mountain streams entering the Pacific Ocean, which forms its western boundary. They receive quite a run of fall salmon and are more or less supplied with trout. The fisheries are limited to the salmon catch from the Tillamook, Nehalem, and Nestucco rivers, on each of which is located one cannery. In 1899 the salmon packed at the three canneries amounted to 25,933 cases, of $91,074 value.

Lincoln County.—Several rivers in this county have fall runs of salmon. There are fishing-grounds near the harbor of Yaquina that are known to abound with numerous varieties of salt-water fish, but have not been worked except experimentally. The present business is

chiefly confined to salmon used by the canners, a limited amount of fresh fish, crabs, and oysters going to the neighboring fresh-fish markets.

Siletz River has one cannery that packed 4,719 cases of salmon of $19,146 value; Alsea River one cannery, 7,160 cases of salmon of $28,176 value; Yaquina River two canneries, 4,850 cases of $17,124 value; a total by the four canneries of Lincoln County of 16,729 cases of $64,446 value.

Shipments of fresh salmon, flounders, and herring by express from Yaquina amounted to 107,627 pounds. Crabs are quite plentiful; 79,260 pounds of $1,635 value were disposed of locally and to the near-by markets.

Yaquina Bay has the only oyster-grounds of Oregon. The beds of native oysters are limited to only a few acres and produce but a small quantity. The total oyster products for 1899 amounted to only 591 sacks of 100 pounds each, valued at $1,625.

The fisheries of Lincoln County represented a capital of $63,163, and employed 234 fishermen and 101 cannery-hands. The fish sold to the canneries and fresh-fish markets amounted to 1,442,730 pounds, which, with oysters, clams, and crabs, yielded the fishermen $23,499.

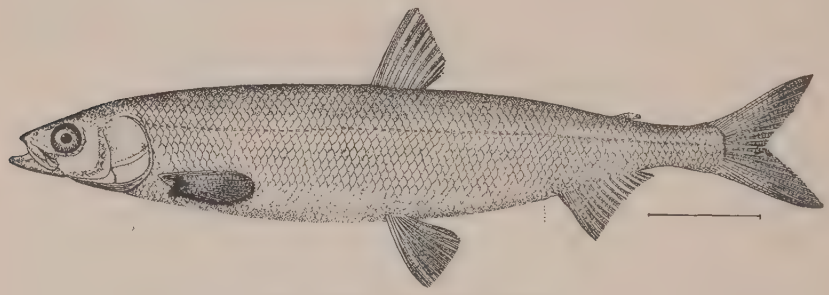
Lane County.—The capital invested in the fisheries of this county amounted to $47,975 in 1899, and there were 95 fishermen and 46 cannery employees. The fisheries are based on the fall run of salmon in the Siuslaw River, and the salmon taken aggregated 781,700 pounds, valued $12,040. 8,600 cases of salmon were packed by the one cannery at Florence, near the mouth of the Siuslaw River; 399 barrels of salmon were salted, and 60,000 pounds of salmon were sold fresh to the local trade.

During 1900 several pound nets were put down in the river near Florence. The pounds at times took 50 to 100 shad, weighing 3 to 5 pounds each. The shad are scarce in these waters, and there is no market for those taken.

Douglas County.—The capital invested in the fisheries of this county, including the value of two salmon canneries, amounted to $66,105; 207 fishermen and 50 cannery hands were employed. The business was confined to the fall run of salmon, of which the two canneries used 603,120 pounds, packing 8,616 cases, valued at $31,211. 32,500 pounds of steelhead were sent by express to Portland, making a total catch of 635,620 pounds, of $14,215 value to the fishermen. A few shad were taken during the season in a pound net near the mouth of the river.

Coos County.—The fisheries here were restricted to the salmon of the Coquille River and Coos Bay and River. One cannery at Parkersburg on the Coquille and two at Coos Bay utilized the entire catch, amounting to 1,052,540 pounds of salmon. The pack of the three canneries amounted to 11,947 cases of $44,518 value. The capital invested in the fisheries was $81,140; 322 fishermen and 105 cannery-hands were employed.

Curry County.—This county is bounded on the west by the Pacific Ocean and on the south by California. At points along the coast good fishing-grounds have been located and were used for a brief time, but there are no favorable shipping facilities. Numerous streams are the spawning grounds of salmon. Rogue River is the largest and most important stream, and has a spring and fall run of salmon. A cannery at Wedderburn near the mouth of the river utilizes the principal part of the salmon taken. Between 1880 and 1890 the annual pack was between 15,000 and 20,000 cases of salmon; in 1889, 21,196; 1890, 19,106; 1891, 19,960. A few miles above Wedderburn is a private fish hatchery, and higher up the stream is the hatchery of the U. S. Fish



SURF SMELT (*Hypomesus pretiosus*).

CALIFORNIA SMELT (*Atherinopsis californiensis.*)

Commission. During 1899 the lower station hatched and planted in the river 1,500,000 salmon, the eggs having been furnished by the Government station. In 1893 the private hatchery was destroyed by fire, and soon after a marked decrease was noticed in the salmon run. The catch continued to decrease up to 1899, when the pack amounted to only 7,226 cases, less than half that of former years. With the rebuilding of the private hatchery, and with one owned by the Government, it is hoped that Rogue River will again have its abundance of salmon and that other streams of the State will also be benefited.

The capital invested in the fisheries of Curry County in 1899 amounted to $59,845, and 56 fishermen and 59 cannery hands were employed. The products were 472,090 pounds of salmon, packing 7,226 cases, valued at $37,125.

Sea lions are quite numerous along the coast, and the steamer of the cannery has been used in pursuing and killing them, to lessen their alleged destruction of salmon. A few men of Port Orford hunted sea lions for their oil and pelts. The animals were shot on the rocks between Cape Blanco and Port Orford, from 4 to 8 gallons of oil being taken from a lion of full growth. The hunters also collected eggs of murres or guillemots from the rocky cliffs near Port Orford. In 1899 1,300 dozen eggs were collected and shipped to San Francisco. The eggs were worth $234 and the sea lions $890.

FISHERIES OF CALIFORNIA.

Nearly all branches of the fisheries of this State show a steady gain in investment and yield during the past four years, the aggregate capital, value of products, and number of employees being as follows:

Items.	1895.	1899.
Capital	$2,612,298	$2,774,493
Value of products	$1,786,483	$2,551,451
Employees	4,770	3,974

The gain in capital was $162,195, and in value of products $764,968.

The three following tables show the number of persons employed, the apparatus and capital, and the products of the fisheries of California in 1899:

Table of persons employed.

How employed.	No.
On vessels fishing	885
On vessels transporting	57
In shore fisheries	2,538
On shore, in canneries, etc	494
Total	3,974

Table of apparatus and capital.

Items.	No.	Value.	Items.	No.	Value.
Vessels, fishing	33	$700,870	Apparatus—shore fisheries:		
Tonnage	5,952		Paranzella nets	10	$1,000
Outfit		413,287	Hoop nets	1,537	3,074
Vessels, transporting	15	55,800	Trammel nets	591	26,280
Tonnage	834		Shrimp nets	1,370	27,800
Outfit		4,220	Lobster pots	578	664
Boats	1,355	150,335	Forks, spades, rakes, hoes, etc		156
Apparatus—vessel fisheries:			Diving outfit		3,000
Seines	2	2,000	Guns and harpoons		322
Beam trawls	4	1,400	Lines, hand and trawl		4,140
Guns		200	Shore and accessory property		820,650
Lines		100	Cash capital		379,700
Apparatus—shore fisheries:					
Seines	113	11,230			
Gill nets	1,979	166,841	Total		2,774,493
Fyke nets	356	1,424			

Table of products.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Albacore or tunny, fresh	49,202	$1,327	Sea bass, salted	14,000	$540
Albacore, salted	65,000	2,600	Sea trout	50,068	1,459
Anchovies	6,826	177	Shad	1,137,801	14,303
Barracuda, fresh	957,420	23,220	Skate	11,000	110
Barracuda, salted	234,085	9,483	Smelt	1,315,249	58,064
Bonito, fresh	50,737	1,133	Sole	32,245	645
Bonito, salted	69,000	2,760	Split-tail	131,926	2,639
Carp	283,514	2,400	Striped bass	1,234,320	61,814
Cat-fish	465,911	12,734	Sturgeon	205,659	11,426
Cod, salted	5,917,131	178,054	Surf-fish	116,290	2,576
Croakers	40,919	1,123	Tomcod	375,538	6,882
Cultus-cod	147,890	3,298	White-fish	50,800	1,097
Flounders, fresh	4,666,215	90,659	Yellow-fin	24,000	480
Flounders, salted	20,090	1,104	Yellow-tail, fresh	75,544	1,513
Hake or white-fish	7,210	72	Yellow-tail, salted	129,100	5,164
Halibut	9,000	270	Abalone, dried	369,411	22,813
Hardhead	185,882	5,849	Abalone, shells	525,453	9,743
Herring, fresh	1,620,478	17,167	Clams, hard[1]	636,534	9,087
Herring, salted	16,539	516	Clams, soft[2]	1,534,400	21,958
Jew-fish, fresh	36,000	751	Oysters, eastern[3]	25,200,000	792,000
Jew-fish, salted	30,000	1,200	Oysters, native[4]	3,600,000	75,000
King-fish	127,198	4,483	Mussels	364,076	3,637
Mackerel, fresh	139,666	5,855	Scallops	3,939	738
Mackerel, salted	14,000	560	Crabs	3,676,680	85,784
Mullet	22,000	610	Spiny lobsters	606,713	14,198
Octopus	5,000	50	Shrimp, dried	698,625	69,862
Perch, fresh	429,485	10,657	Shrimp in shells	903,375	36,135
Perch, salted	3,000	120	Shrimp shells	2,445,186	4,889
Pike	16,005	639	Squid, dried	622,740	18,682
Pompano	13,135	4,457	Frogs	20,687	20,638
Rock-fish, fresh	1,177,980	35,955	Terrapin	107,869	10,376
Rock-fish, salted	54,830	2,231	Whalebone	207,392	436,272
Salmon:			Whale oil[5]	507,300	20,191
Blueback	21,600	755	Seal oil	5,250	210
Chinook, fresh	7,084,885	255,249	Sea-lion pelts	13,000	612
Chinook, salted	3,000	210	Algæ	35,824	896
Silver	60,160	2,105	Sea-otter pelts	----------	1,000
Steelhead	113,600	3,876	Trade furs	----------	3,422
Sardines	2,383,000	17,790	Other products	96,276	3,070
Sculpin	3,000	75			
Sea bass, fresh	924,156	19,952	Total	74,559,019	2,551,451

[1] 10,609 bushels. [2] 21,920 bushels. [3] 360,000 bushels. [4] 60,000 bushels. [5] 67,628 gallons.

The increase in the general fish business of 1899 over that of 1895 amounted to 9,439,829 pounds and $383,888 in value, the most noticeable gain being in striped bass. In crabs there is an increase of 1,111,680 pounds and $24,034 in value, the remainder of the increase being in oysters, spiny lobsters, whalebone, and other products. The products of the seal fisheries in 1895 amounted to $116,785 in value. On account of the suspension of pelagic sealing there is to be noted a decrease in the employees and an absence of seal products in 1899.

The shrimp fisheries are entirely in the hands of Chinese, whose camps are located near the fishing-grounds in San Francisco Bay, as follows: San Pablo, Contra Costa County; San Quentin and Point Pedro, Marin County; Redwood City and Burlingame, San Mateo County; Newark, Alameda County; Hunters Point, San Francisco County. At these stations an aggregate of 158 Chinese work 1,390 shrimp nets. Their headquarters are at San Francisco under the name of the Union Shrimp Company. The capital invested in boats, nets, and shore property amounted to $45,100. This company employs the fishermen, regulates the amount and preparation of the catch, some of the camps preparing only the hulled shrimp, which are largely used for export.

The total products of the shrimp fishery in 1899, as they came from the water, amounted to 8,115,468 pounds and were disposed of as follows: Boiled and sold with the hulls on, in San Francisco markets, 903,375 pounds, worth $36,135; cooked, hulled, and dried for foreign and domestic markets, 698,625 pounds, of $69,862 value. From the latter the shells are saved and sold for fertilizer, 2,445,186 pounds of shells, of $4,889 value, being disposed of at San Francisco and exported.

The exports of hulled shrimp and of shrimp shells to China have long been of considerable importance. Since the troubles in China the exports have largely fallen off, the year 1899 showing a decrease in the value of the products of $51,863 as compared with 1895. The total value of the products of 1899 were $110,886, realized from 4,047,186 pounds of shrimps and shells as placed on the market.

The salmon fisheries of the Sacramento River show a large increase since 1895, those of the northern part of the State, in Humboldt and Del Norte counties, showing a decrease; the aggregate net gain was 2,169,834 pounds. The catch was disposed of mainly to fresh-fish dealers.

The operations in salmon canning for 1895 and 1899 are shown by the following table:

Salmon, canned.	1895.	1899.
	Cases.	*Cases.*
On Sacramento River	25,185	32,580
On Klamath River	1,600	1,600
On Smith River	2,250	.....
Total pack of the State	29,035	34,180

FISHING STATISTICS OF CALIFORNIA BY COUNTIES.

The following tables show, by counties, the detailed statistics of the California fisheries in 1899:

Table showing the number of persons employed in the fisheries of California in 1899.

Counties.	On vessels fishing.	On vessels transporting.	In shore fisheries.	On shore, in canneries, etc.	Total.
Alameda	.....	.....	36	.....	36
Butte	.....	.....	2	.....	2
Contra Costa	.....	.....	363	77	440
Del Norte	.....	.....	22	30	52
Humboldt	.....	.....	182	3	185
Los Angeles	7	4	187	100	298
Marin	.....	.....	157	57	214
Monterey	.....	.....	186	1	187
Orange	.....	.....	34	.....	34
Sacramento	.....	.....	108	12	120
San Diego	14	.....	161	6	181
San Francisco	864	41	489	81	1,475
San Joaquin	.....	.....	27	6	33
San Luis Obispo	.....	.....	26	.....	26
San Mateo	.....	.....	30	.....	30
Santa Barbara	.....	8	41	.....	49
Santa Cruz	.....	.....	74	5	79
Solano	.....	4	306	101	411
Ventura	.....	.....	6	.....	6
Yolo	.....	.....	101	15	116
Total	885	57	2,538	494	3,974

Table showing, by counties, the vessels, boats, apparatus, and property employed in the fisheries of California in 1899.

Counties.	Vessels fishing.				Vessels transporting.				Boats.	
	No.	Tonnage.	Value.	Value of outfit.	No.	Tonnage.	Value.	Value of outfit.	No.	Value.
Alameda									13	$340
Butte									1	30
Contra Costa									173	22,075
Del Norte									10	260
Humboldt									113	1,760
Los Angeles	2	38	$6,000	$220	1	12	$1,500	$500	143	15,135
Marin									34	2,000
Monterey									130	11,140
Orange									19	620
Sacramento									54	2,195
San Diego	3	24	1,700	1,354					137	17,600
San Francisco	28	5,890	693,170	411,713	9	763	48,200	2,920	194	39,400
San Joaquin									21	1,365
San Luis Obispo									20	1,730
San Mateo									6	600
Santa Barbara					3	27	4,900	600	28	1,345
Santa Cruz									46	5,460
Solano					2	32	1,200	200	153	25,365
Ventura									3	150
Yolo									57	1,765
Total	33	5,952	700,870	413,287	15	834	55,800	4,220	1,355	150,335

Counties.	Apparatus used in the vessel fisheries.						
	Seines.			Beam trawls.		Value of guns.	Value of lines.
	No.	Length, feet.	Value.	No.	Value.		
Los Angeles	2	1,440	$2,000				
San Diego						$200	$100
San Francisco				4	$1,400		

Counties.	Apparatus used in the shore fisheries.									
	Seines.			Gill nets.			Fyke nets.		Paranzella nets.	
	No.	Length, feet.	Value.	No.	Length, feet.	Value.	No.	Value.	No.	Value.
Butte				1	570	$100				
Contra Costa				196	312,300	54,850				
Del Norte	1	501	$175	10	4,500	500				
Humboldt	11	6,900	1,725	190	57,000	12,825				
Los Angeles	20	5,898	1,455	108	62,820	8,805				
Marin	8	2,400	800	114	20,810	3,420				
Monterey	20	5,556	2,500	178	58,527	7,852				
Orange	8	4,800	715	1	180	35				
Sacramento	1	300	50	53	49,050	7,550	75	$300		
San Diego	4	1,320	270	58	10,860	1,046				
San Francisco	12	4,320	1,500	465	101,700	10,575			10	$1,000
San Joaquin	7	1,050	350	12	14,400	2,100	56	224		
San Luis Obispo				149	11,920	4,080				
Santa Barbara				73	11,430	1,775				
Santa Cruz	7	3,360	580	150	46,350	6,448				
Solano				171	188,820	40,750	25	100		
Ventura	2	600	150	5	630	255				
Yolo	12	5,760	960	45	26,400	3,875	200	800		
Total	113	42,765	11,230	1,979	978,267	166,841	356	1,424	10	1,000

Counties.	Apparatus used in the shore fisheries—continued.									
	Hoop nets.		Trammel nets.			Shrimp nets.		Lobster pots.		
	No.	Value.	No.	Length, feet.	Value.	No.	Value.	No.	Value.	
Alameda						50	$1,000			
Contra Costa	10	$20	5	6,000	$1,000	150	3,000			
Los Angeles			107	78,900	13,000			200	$200	
Marin			19	4,560	570	520	10,800			
Monterey			25	4,500	750					
Orange			2	360	40			93	115	
San Diego			50	12,000	1,000			80	100	
San Francisco	1,527	3,054	290	69,600	7,250	350	7,000			
San Mateo						300	6,000			
Santa Barbara			20	3,000	400			175	219	
Santa Cruz			71	12,780	2,130					
Solano			2	840	140					
Ventura								30	30	
Total	1,537	$3,074	591	192,540	26,280	1,370	27,800	578	664	

Table showing, by counties, the vessels, boats, apparatus, and property employed in the fisheries of California in 1899—Continued.

Counties.	Apparatus used in the shore fisheries—continued.				Shore and accessory property.	Cash capital.	Total investment.
	Value of forks, spades, rakes, hoes, etc.	Value of diving outfit.	Value of guns and harpoons.	Value of trawl and hand lines.			
Alameda	$15	.....	.....	.....	$575	.....	$1,930
Butte	.....	.....	.....	.....	100	.....	230
Contra Costa	32	.....	.....	.....	38,600	$35,000	154,577
Del Norte	.....	.....	.....	.....	10,500	3,200	14,635
Humboldt	15	.....	.....	$20	10,300	6,000	32,645
Los Angeles	29	$1,000	.....	912	26,600	36,000	113,356
Marin	33	.....	.....	50	67,340	.....	85,013
Monterey	22	1,200	$252	1,015	12,240	6,000	42,971
Orange	.....	.....	.....	150	575	.....	2,250
Sacramento	.....	.....	.....	20	10,925	10,000	31,040
San Diego	.....	800	.....	445	7,575	.....	32,190
San Francisco	.....	.....	.....	200	578,900	230,000	2,036,282
San Joaquin	.....	.....	.....	30	5,150	2,000	11,219
San Luis Obispo	5	.....	70	435	3,200	500	10,020
San Mateo	.....	.....	.....	.....	3,000	.....	9,600
Santa Barbara	.....	.....	.....	71	3,895	5,000	18,205
Santa Cruz	2	.....	.....	707	2,175	.....	17,502
Solano	.....	.....	.....	70	33,900	44,000	145,725
Ventura	3	.....	.....	.....	50	.....	638
Yolo	.....	.....	.....	15	5,050	2,000	14,465
Total	156	3,000	322	4,140	820,650	379,700	2,774,493

Table showing, by counties, apparatus, and species, the yield of the vessel fisheries of California in 1899.

Apparatus and species.	Los Angeles.		San Diego.		San Francisco.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Beam trawls:								
Cultus-cod	.....	.....	.....	.....	117,890	$2,358	117,890	$2,358
Flounders	.....	.....	.....	.....	1,825,455	31,945	1,825,455	31,945
Halibut	.....	.....	.....	.....	9,000	270	9,000	270
Hake or white-fish	.....	.....	.....	.....	7,210	72	7,210	72
King-fish	.....	.....	.....	.....	8,500	127	8,500	127
Octopus	.....	.....	.....	.....	5,000	50	5,000	50
Rock-fish	.....	.....	.....	.....	11,915	238	11,915	238
Sea bass	.....	.....	.....	.....	261,902	5,238	261,902	5,238
Skate	.....	.....	.....	.....	11,000	110	11,000	110
Tomcod	.....	.....	.....	.....	325,538	4,882	325,538	4,882
Total	.....	.....	.....	.....	2,583,410	45,290	2,583,410	45,290
Lines:								
Albacore, salted	.....	.....	16,250	$650	.....	.....	16,250	650
Barracuda, salted	.....	.....	50,000	2,000	.....	.....	50,000	2,000
Bonito, salted	.....	.....	17,250	690	.....	.....	17,250	690
Cod, salted	.....	.....	.....	.....	5,917,131	178,054	5,917,131	178,054
Jew-fish, salted	.....	.....	7,500	300	.....	.....	7,500	300
Mackerel, salted	.....	.....	3,500	140	.....	.....	3,500	140
Rock-fish, salted	.....	.....	5,000	200	.....	.....	5,000	200
Yellow-tail, salted	.....	.....	28,500	1,140	.....	.....	28,500	1,140
Total	.....	.....	128,000	5,120	5,917,131	178,054	6,245,131	183,174
Seines:								
Sardines	1,000,000	$10,000	.....	.....	.....	.....	1,000,000	10,000
Miscellaneous:								
Sea otter	.....	.....	.....	1,000	.....	.....	.....	1,000
Trade furs	.....	.....	.....	.....	.....	3,422	.....	3,422
Whalebone	.....	.....	.....	.....	207,392	436,272	207,392	436,272
Whale oil	.....	.....	.....	.....	471,510	18,998	471,510	18,998
Total	.....	.....	.....	1,000	678,902	458,692	678,902	459,692
Grand total	1,000,000	10,000	128,000	6,120	9,179,443	682,036	10,307,443	698,156

Table showing, by counties and species, the yield of the fisheries of California in 1899.

Species.	Alameda.		Butte.		Contra Costa.		Del Norte.		Humboldt.	
	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Cat-fish					11,100	$222				
Cultus-cod									4,000	$120
Flounders, fresh					43,290	666			95,200	2,304
Hardhead					25,740	257				
Herring, fresh									30,000	700
Herring, salted									9,000	290
Perch, fresh									26,000	490
Rock-fish, fresh									20,000	600
Salmon, blueback									21,600	755
Salmon, chinook, fresh			12,000	$480	2,807,893	99,771	136,000	$2,340	176,100	5,189
Salmon, silver									60,160	2,105
Salmon, steelhead									113,600	3,876
Sardines									20,000	400
Shad					320,194	4,236				
Smelt									81,000	2,430
Striped bass					575,947	23,449				
Sturgeon			6,654	333	49,860	3,465			2,000	30
Surf-fish									4,000	100
Clams, hard									24,000	600
Clams, soft	612,480	$8,750			767,300	10,971			1,500	50
Mussels	344,400	3,440								
Crabs									12,000	275
Shrimp, dried	17,719	1,771			88,594	8,859				
Shrimp, in shells	82,125	3,285			409,300	16,372				
Shrimp shells	62,015	124			310,078	620				
Frogs					2,178	2,178			4,000	4,000
Terrapin					17,779	1,796				
Total	1,118,739	17,370	18,654	813	5,429,253	172,862	136,000	2,340	704,160	24,314

Species.	Los Angeles.		Marin.		Monterey.		Napa.		Orange.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.
Albacore or tunny	20,776	$312			27,015	$963				
Anchovies					6,826	177				
Barracuda, fresh	388,365	7,812			183,520	5,385			46,000	$920
Barracuda, salted					22,085	883				
Bonito	12,420	186			9,817	197				
Croakers	11,219	272							9,700	251
Cultus-cod	11,000	220								
Flounders, fresh	1,085,463	26,412			59,730	2,149			89,910	2,268
Flounders, salted					20,090	1,104				
Herring, fresh			20,200	$101	26,278	526				
Herring, salted					7,539	226				
Jew-fish	22,000	331								
King-fish	35,240	705			6,010	180				
Mackerel	49,240	1,460			55,525	3,332				
Mullet									10,000	250
Perch	70,192	1,562	68,560	1,715	116,832	2,385			5,800	159
Pompano	6,600	990								
Rock-fish, fresh	244,000	5,631	43,600	2,180	424,307	12,744			68,607	1,544
Rock-fish, salted					31,010	1,240				
Salmon, chinook, fresh					224,486	11,184				
Salmon, chinook, salted					3,000	210				
Sardines	1,015,000	10,150								
Sculpin	3,000	75								
Sea bass, fresh	77,675	1,554	102,400	1,536	117,000	3,350				
Sea bass, salted					2,000	60				
Sea trout	27,100	755			20,600	618				
Smelt	163,162	4,794	100,670	4,530	57,024	2,366			25,600	1,068
Surf-fish	64,890	1,238							18,400	368
White-fish	43,100	878								
Yellow-fin	24,000	480								
Yellow-tail, fresh	53,000	1,010			11,813	236			5,000	100
Yellow-tail, salted					15,100	604				
Abalone, dried	63,930	7,622			108,375	5,897				
Abalone, shells	50,185	1,003			63,293	633				
Clams, hard	273,680	2,659	234,735	4,401	28,800	576			19,000	285
Clams, soft			153,120	2,187						
Mussels					18,967	190				
Scallops	3,939	738								
Spiny lobsters	140,886	3,522							57,400	1,435
Shrimp, dried			263,250	26,325						
Shrimp, in shells			411,950	16,478						
Shrimp shells			921,375	1,842						
Squid, dried					622,740	18,682				
Frogs			3,200	3,200	100	60	3,600	$3,600		
Whale oil					35,790	1,193				
Algæ					35,824	896				
Other products					94,316	2,575				
Total	3,960,062	82,371	2,323,060	64,495	2,455,812	80,821	3,600	3,600	355,417	8,648

Table showing, by counties and species, the yield of the fisheries of California in 1899—Continued.

Species.	Sacramento.		San Diego.		San Francisco.		San Joaquin.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Albacore or tunny, salted			65,000	$2,600				
Barracuda, fresh			154,754	4,642				
Barracuda, salted			200,000	8,000				
Bonito, fresh			7,500	225				
Bonito, salted			69,000	2,760				
Carp	6,339	$63			174,000	$1,305	61,275	$613
Cat-fish	175,031	4,685					76,870	2,721
Cod, salted					5,917,131	178,054		
Croakers			20,000	600				
Cultus-cod					132,890	2,958		
Flounders			125,797	3,774	3,091,455	50,977		
Hake or white-fish					7,210	72		
Halibut					9,000	270		
Hardhead	16,967	581					33,400	1,169
Herring			20,000	600	1,524,000	15,240		
Jew-fish, fresh			14,000	420				
Jew-fish, salted			30,000	1,200				
King-fish			7,000	210	68,500	3,127		
Mackerel, fresh			13,200	396				
Mackerel, salted			14,000	560				
Mullet			12,000	360				
Octopus					5,000	50		
Perch	1,004	173	18,381	552	40,125	1,605		
Pike	905	35					11,800	472
Rock-fish, fresh			135,797	4,074	46,915	1,638		
Rock-fish, salted			20,000	800				
Salmon, chinook	405,733	15,946			55,680	2,227	63,975	2,559
Sardines			20,000	600	1,328,000	6,640		
Sea bass			19,000	570	336,902	6,738		
Shad	1,226	24			619,496	6,195	178,825	3,577
Skate					11,000	110		
Smelt			33,000	990	716,000	35,800		
Split-tail	5,826	117						
Striped bass	113	6			587,200	32,232	12,750	637
Sturgeon	8,880	4,555			63,810	3,420	1,335	67
Surf-fish			21,000	630				
Tomcod					375,538	6,882		
White-fish			5,200	156				
Yellow-tail, salted			114,000	4,560				
Abalone, dried			140,981	7,049				
Abalone, shells			315,340	6,307				
Oysters, Eastern					25,200,000	792,000		
Oysters, native					3,600,000	75,000		
Crabs					3,664,680	85,509		
Spiny lobsters			61,000	1,680				
Shrimps, dried					177,187	17,719		
Shrimp shells					620,156	1,240		
Terrapin							26,460	2,520
Whalebone					207,392	436,272		
Whale oil					471,510	18,998		
Sea-otter pelts								
Trade furs						3,422		
Total	622,024	22,085	1,655,950	55,315	49,000,777	1,785,700	466,690	14,335

Species.	Solano.		Sonoma.		Stanislaus.		Ventura.		Yolo.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Carp									41,900	$419
Cat-fish	8,910	$356							194,000	4,750
Flounders	6,000	180					21,000	$630		
Hardhead	23,250	814							86,525	3,028
Perch									2,520	344
Pike									3,300	132
Rock-fish							8,000	240		
Salmon, chinook	2,834,878	100,631							278,800	11,188
Shad	18,060	271								
Smelt							6,000	180		
Split-tail									126,100	2,522
Striped bass	108,310	5,490								
Sturgeon	71,080	3,554							2,040	102
Surf-fish							8,000	240		
Clams, hard							16,000	160		
Spiny lobsters							15,000	450		
Terrapin	10,080	360	13,650	$1,300	39,900	$3,800				
Total	3,080,568	112,256	13,650	1,300	39,900	3,800	74,000	1,900	735,185	22,485

Table showing, by counties and species, the yield of the fisheries of California in 1899—Continued.

Species.	San Luis Obispo.		San Mateo.		Santa Barbara.		Santa Clara.		Santa Cruz.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Albacore or tunny	1,411	$52								
Barracuda, fresh	35,268	1,231			47,900	$1,198			101,613	$2,032
Barracuda, salted	12,000	600								
Bonito					21,000	525				
Flounders	9,192	346			27,000	710			12,178	243
King-fish	1,868	69			4,000	100			4,580	92
Mackerel	2,118	78			12,926	323			6,657	266
Perch, fresh	2,822	97			6,000	150			71,249	1,425
Perch, salted	3,000	120								
Pompano									6,535	3,467
Rock-fish, fresh	112,996	4,575			14,800	370			58,958	2,359
Rock-fish, salted	3,820	191								
Salmon, chinook	4,000	320							85,340	3,414
Sea bass, fresh	39,194	1,458			21,300	532			210,685	4,214
Sea bass, salted	12,000	480								
Sea trout	2,368	86								
Smelt	39,597	1,421			7,000	175			86,196	4,310
Sole									32,245	645
White-fish					2,500	63				
Yellow-tail	1,411	52			4,320	115				
Abalone, dried					56,125	2,245				
Abalone shells					96,635	1,800				
Clams, hard	40,015	400							304	6
Mussels									709	7
Spiny lobsters					332,427	7,111				
Shrimp, dried			151,875	$15,188						
Shrimp shells			531,562	1,063						
Frogs			3,880	3,880			3,400	$3,400	329	320
Sea-lion oil	5,250	210								
Sea-lion pelts	13,000	612								
Other products		315			1,960	180				
Total	341,330	12,713	687,317	20,131	655,893	15,597	3,400	3,400	677,578	22,800

Table showing, by counties, species, and apparatus of capture, the yield of the shore fisheries of California in 1899.

Apparatus and species.	Los Angeles.		Marin.		Monterey.		Napa.		Orange.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:										
Albacore or tunny					6,200	$224				
Anchovies					6,826	177				
Barracuda, fresh	350,000	$7,000			140,640	4,099			3,000	$60
Barracuda, salted					17,000	680				
Flounders, fresh	139,763	3,478			35,494	1,420				
Flounders, salted					20,090	1,104				
Herring, fresh			15,000	$75	20,000	400				
Herring, salted					7,539	226				
Jew-fish	1,500	23								
King-fish	30,000	600			6,010	180				
Mackerel	16,000	320			12,000	720				
Perch					48,232	965				
Pompano	3,000	450								
Rock-fish, fresh	13,000	293			140,935	4,228				
Rock-fish, salted					10,000	400				
Sardines	15,000	150								
Sea bass, fresh	66,675	1,334	91,080	1,366	117,000	3,350				
Sea bass, salted					2,000	60				
Smelt	79,482	2,284	67,114	3,020	41,904	1,761				
Surf-fish	12,000	180								
White-fish	35,000	700								
Yellow-tail	6,000	120			3,000	60				
Total	767,420	16,932	173,194	4,461	634,870	20,054			3,000	60
Seines:										
Croakers	3,219	72							9,700	251
Flounders					8,306	332			4,000	120
Herring			5,200	26	6,278	126				
King-fish	5,240	105								
Mullet									10,000	250
Perch	40,192	812	51,420	1,286	45,100	950			5,800	159
Pompano	3,600	540								
Smelt	83,680	2,510	33,556	1,510	15,120	605			25,600	1,068
Squid, dried					622,740	18,682				
Surf-fish	52,890	1,058							18,400	368
White-fish	1,500	30								
Total	190,321	5,127	90,176	2,822	697,544	20,695			73,500	2,216

Table showing, by counties, species, and apparatus of capture, the yield of the shore fisheries of California in 1899—Continued.

Apparatus and species.	Los Angeles.		Marin.		Monterey.		Napa.		Orange.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Trammel nets:										
Albacore or tunny	20,000	$800								
Bonito	6,000	90								
Croakers	8,000	200								
Cultus-cod	5,000	100								
Flounders	807,000	19,475			7,500	$60			10,000	$250
Jew-fish	15,000	225								
Perch	30,000	750	17,140	$429	23,500	470				
Rock-fish	60,000	1,350			900	36			8,000	180
Sculpin	3,000	75								
Sea bass	11,000	220	11,320	170						
Sea trout	23,000	632								
Yellow-fin	24,000	480								
Yellow-tail	35,000	700								
Total	1,047,000	24,597	28,460	599	31,900	566			18,000	430
Lines, trawl and hand:										
Albacore or tunny	776	12			20,815	739				
Barracuda, fresh	38,365	812			42,880	1,286			43,000	860
Barracuda, salted					5,085	203				
Bonito	6,420	96			9,817	197				
Cultus-cod	6,000	120								
Flounders	138,700	3,459			8,430	337			75,910	1,898
Jew-fish	5,500	83								
Mackerel	33,240	1,140			43,525	2,612				
Rock-fish, fresh	171,000	3,988	43,600	2,180	282,472	8,480			60,607	1,364
Rock-fish, salted					21,010	840				
Salmon, chinook, fresh					224,486	11,184				
Salmon, chinook, salted					3,000	210				
Sea trout	4,100	123			20,600	618				
White-fish	6,600	148								
Yellow-tail, fresh	12,000	190			8,813	176			5,000	100
Yellow-tail, salted					15,100	604				
Total	422,701	10,171	43,600	2,180	706,033	27,486			184,517	4,222
Pots:										
Spiny lobsters	140,886	3,522							57,400	1,435
Shrimp nets:										
Shrimps in shells			411,950	16,478						
Shrimps, dried			263,250	26,325						
Shrimp shells			921,375	1,842						
Total			1,596,575	44,645						
Tongs, rakes, forks, etc.:										
Scallops	3,939	738								
Clams, hard	273,680	2,659	234,735	4,401	28,800	576			19,000	285
Clams, soft			153,120	2,187						
Mussels					18,967	190				
Total	277,619	3,397	387,855	6,588	47,767	766			19,000	285
Miscellaneous apparatus:										
Abalone, dried	63,930	7,622			108,375	5,897				
Abalone, shells	50,185	1,003			63,293	633				
Algæ					35,824	896				
Frogs			3,200	3,200	100	60	3,600	$3,600		
Whale oil					35,790	1,193				
Other products					94,316	2,575				
Total	114,115	8,625	3,200	3,200	337,698	11,254	3,600	3,600		
Grand total	2,960,062	72,371	2,323,060	64,495	2,455,812	80,821	3,600	3,600	355,417	8,648

Table showing, by counties, species, and apparatus of capture, the yield of the shore fisheries of California in 1899—Continued.

Apparatus and species.	San Luis Obispo.		San Mateo.		Santa Barbara.		Santa Clara.		Santa Cruz.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:										
Albacore or tunny	1,411	$52								
Barracuda, fresh	31,332	1,073			35,900	$898			101,613	$2,032
Barracuda, salted	12,000	600								
Flounders	9,192	346			10,800	304				
King-fish	1,868	69							4,580	92
Mackerel	2,118	78							6,657	266
Perch, fresh	2,822	97								
Perch, salted	3,000	120								
Pompano									4,495	2,447
Rock-fish					1,800	45				
Sea trout	2,368	86								
Sea bass, fresh	31,321	1,133			21,300	532			210,685	4,214
Sea bass, salted	12,000	480								
Smelt	39,597	1,421			7,000	175			86,196	4,310
Yellow-tail	1,411	52								
Total	150,440	5,607			76,800	1,954			414,226	13,361
Seines:										
Pompano									2,040	1,020
Trammel nets:										
Bonito					15,000	375				
Flounders					13,100	328			12,178	243
King-fish					4,000	100				
Mackerel					5,176	129				
Perch					6,000	150			68,674	1,373
Rock-fish									28,158	1,126
Shad									32,245	645
White-fish					2,500	63				
Yellow-tail					2,520	63				
Total					48,296	1,208			141,255	3,387
Lines, trawl and hand:										
Barracuda	3,936	158			12,000	300				
Bonito					6,000	150				
Flounders					3,100	78				
Mackerel					7,750	194				
Perch									2,575	52
Rock-fish, fresh	112,996	4,575			13,000	325			30,800	1,233
Rock-fish, salted	3,820	191								
Salmon, chinook	4,000	320							85,340	3,414
Sea bass	7,873	325								
Yellow-tail					1,800	52				
Total	132,625	5,569			43,650	1,099			118,715	4,699
Pots:										
Spiny lobsters					332,427	7,111				
Shrimp nets:										
Shrimp, dried			151,875	$15,188						
Shrimp, shells			531,562	1,063						
Total			683,437	16,251						
Tongs, rakes, forks, etc.:										
Clams, hard	40,015	400							304	6
Mussels									709	7
Total	40,015	400							1,013	13
Miscellaneous apparatus:										
Abalone, dried					56,125	2,245				
Abalone, shells					96,635	1,800				
Frogs			3,880	3,880			3,400	$3,400	329	320
Sea-lion pelts	13,000	612								
Sea-lion oil	5,250	210								
Sea-lion trimmings		315								
Other products					1,960	180				
Total	18,250	1,137	3,880	3,880	154,720	4,225	3,400	3,400	329	320
Grand total	341,330	12,713	687,317	20,131	655,893	15,597	3,400	3,400	677,578	22,800

Table showing, by counties, species, and apparatus of capture, the yield of the shore fisheries of California in 1899—Continued.

Apparatus and species.	Alameda.		Butte.		Contra Costa.		Del Norte.		Humboldt.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:										
Flounders, fresh					3,290	$66				
Herring, fresh									10,000	$100
Salmon, chinook			12,000	$480	2,807,893	99,771	112,000	$2,100	138,600	3,876
Salmon, silver									48,160	1,685
Salmon, blueback									19,100	668
Salmon, steelhead									113,600	3,876
Sardines									10,000	100
Shad					218,994	2,212				
Smelt									80,000	2,400
Striped bass					575,147	23,409				
Sturgeon			6,654	333	49,860	3,465				
Total			18,654	813	3,655,184	128,923	112,000	2,100	419,460	12,705
Seines:										
Flounders									73,200	1,424
Herring, fresh									20,000	600
Herring, salted									9,000	290
Perch									26,000	490
Salmon, chinook							24,000	240	37,500	1,313
Salmon, silver									12,000	420
Salmon, blueback									2,500	87
Sardines									10,000	300
Smelt									1,000	30
Sturgeon									2,000	30
Surf-fish									4,000	100
Crabs									12,000	275
Total							24,000	240	209,200	5,359
Trammel nets:										
Flounders					40,000	600				
Shad					101,200	2,024				
Striped bass					800	40				
Total					142,000	2,664				
Lines, trawl and hand:										
Cultus-cod									4,000	120
Flounders									22,000	880
Rock-fish, fresh									20,000	600
Total									46,000	1,600
Hoop nets:										
Cat-fish					11,100	222				
Hardhead					25,740	257				
Total					36,840	479				
Shrimp nets:										
Shrimp, in shells	82,125	$3,285			409,300	16,372				
Shrimp, dried	17,719	1,771			88,594	8,859				
Shrimp shells	62,015	124			310,078	620				
Total	161,859	5,180			807,972	25,851				
Tongs, rakes, forks, etc.:										
Clams, hard									24,000	600
Clams, soft	612,480	8,750			767,300	10,971			1,500	50
Mussels	344,400	3,440								
Total	956,880	12,190			767,300	10,971			25,500	650
Miscellaneous apparatus:										
Frogs					2,178	2,178			4,000	4,000
Terrapin					17,779	1,796				
Total					19,957	3,974			4,000	4,000
Grand total	1,118,739	17,370	18,654	813	5,429,253	172,862	136,000	2,340	704,160	24,314

Table showing, by counties, species, and apparatus of capture, the yield of the shore fisheries of California in 1899—Continued.

Apparatus and species.	Sacramento.		San Diego.		San Francisco.		San Joaquin.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:								
Barracuda			47,546	$1,426				
Herring			15,000	450	1,524,000	$15,240		
Salmon, chinook	405,733	$15,946					63,975	$2,559
Sardines			20,000	600	1,124,000	5,620		
Sea bass					75,000	1,500		
Shad	1,226	24					178,825	3,577
Smelt			19,000	570	716,000	35,800		
Striped bass	113	6					12,750	637
Sturgeon	8,880	4,555					1,335	67
Total	415,952	16,431	101,546	3,046	3,439,000	58,160	256,885	6,840
Seines:								
Carp							20,425	204
Cat-fish	54,861	1,698					20,500	718
Croakers			5,000	150				
Flounders			6,000	180	172,800	2,592		
Hardhead							9,830	345
Herring			5,000	150				
King-fish			1,000	30				
Perch			13,428	403	40,125	1,605		
Pike							4,300	172
Sardines					204,000	1,020		
Shad					45,000	450		
Smelt			14,000	420				
Striped bass					230,400	13,824		
Sturgeon					8,130	480		
Surf-fish			21,000	630				
Total	54,861	1,698	65,428	1,963	700,455	19,971	55,055	1,439
Trammel nets:								
Carp					174,000	1,305		
Croakers			15,000	450				
Flounders			62,977	1,889	1,044,000	15,660		
King-fish			6,000	180				
Mullet			12,000	360				
Perch			4,953	149				
Rock-fish			13,579	407				
Salmon, chinook					55,680	2,227		
Sea bass			19,000	570				
Shad					574,496	5,745		
Striped bass					306,800	18,408		
Sturgeon					55,680	2,940		
Crabs					334,080	7,795		
Total			133,509	4,005	2,544,736	54,080		
Lines, trawl and hand:								
Albacore or tunny, salted			48,750	1,950				
Barracuda, fresh			107,208	3,216				
Barracuda, salted			150,000	6,000				
Bonito, fresh			7,500	225				
Bonito, salted			51,750	2,070				
Carp	550	5						
Cat-fish	42,612	1,024					4,570	183
Cultus-cod					15,000	600		
Flounders			56,820	1,705	1,200	60		
Jew-fish, fresh			14,000	420				
Jew-fish, salted			22,500	900				
Mackerel, fresh			13,200	396				
Mackerel, salted			10,500	420				
Pike	122	5						
Rock-fish, fresh			122,218	3,667	35,000	1,400		
Rock-fish, salted			15,000	600				
White-fish			5,200	156				
Yellow-tail, salted			85,500	3,420				
Total	43,284	1,034	710,146	25,145	51,200	2,060	4,570	183
Fyke nets:								
Carp	5,789	58					40,850	409
Cat-fish	77,558	1,963					51,800	1,820
Hardhead	16,967	581					23,570	824
Perch	1,004	173						
Pike	783	30					7,500	300
Split-tail	5,826	117						
Total	107,927	2,922					123,720	3,353
Paranzella nets:								
Flounders					48,000	720		
King-fish					60,000	3,000		
Tomcod					50,000	2,000		
Total					158,000	5,720		

Table showing, by counties, species, and apparatus of capture, the yield of the shore fisheries of California in 1899—Continued.

Apparatus and species.	Sacramento.		San Diego.		San Francisco.		San Joaquin.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Hoop nets:								
Crabs					3,330,600	$77,714		
Pots:								
Spiny lobsters			61,000	$1,680				
Shrimp nets:								
Shrimp, dried					177,187	17,719		
Shrimp shells					620,156	1,240		
Total					797,343	18,959		
Tongs, rakes, forks, etc.:								
Oysters, eastern					25,200,000	792,000		
Oysters, native					3,600,000	75,000		
Total					28,800,000	867,000		
Miscellaneous apparatus:								
Abalone, dried			140,981	7,049				
Abalone shells			315,340	6,307				
Terrapin							26,460	$2,520
Total			456,321	13,356			26,460	2,520
Grand total	622,024	$22,085	1,527,950	49,195	39,821,334	1,103,664	466,690	14,335

Apparatus and species.	Solano.		Sonoma.		Stanislaus.		Ventura.		Yolo.	
	Lbs.	Value.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Gill nets:										
Flounders							21,000	$630		
Rock-fish							8,000	240		
Salmon, chinook	2,834,878	$100,631							278,800	$11,188
Shad	3,060	21								
Striped bass	108,310	5,490								
Sturgeon	61,080	3,054							2,040	102
Total	3,007,328	109,196					29,000	870	280,840	11,290
Seines:										
Carp									15,500	155
Cat-fish									45,950	1,149
Hardhead									22,050	772
Perch									1,680	302
Pike									800	32
Smelt							6,000	180		
Split-tail									46,000	920
Surf-fish							8,000	240		
Total							14,000	420	131,980	3,330
Trammel nets:										
Flounders	6,000	180								
Shad	15,000	250								
Sturgeon	10,000	500								
Total	31,000	930								
Lines, trawl and hand:										
Carp									2,000	20
Cat-fish	8,910	356							10,200	255
Pike									1,300	52
Total	8,910	356							13,500	327
Fyke nets:										
Carp									24,400	244
Cat-fish									137,850	3,346
Hardhead	23,250	814							64,475	2,256
Perch									840	42
Pike									1,200	48
Split-tail									80,100	1,602
Total	23,250	814							308,865	7,538
Pots:										
Spiny lobsters							15,000	450		
Tongs, rakes, forks, etc.:										
Clams							16,000	160		
Miscellaneous apparatus:										
Terrapin	10,080	960	13,650	$1,300	39,900	$3,800				
Grand total	3,080,568	112,256	13,650	1,300	39,900	3,800	74,000	1,900	735,185	22,485

Summary, by apparatus and species, of the shore fisheries of California in 1899.

Apparatus and species.	Lbs.	Value.
Gill nets:		
Albacore or tunny	7,611	$276
Anchovies	6,826	177
Barracuda, fresh	710,031	16,588
Barracuda, salted	29,000	1,280
Flounders, fresh	219,539	6,244
Flounders, salted	20,090	1,104
Herring, fresh	1,584,000	16,265
Herring, salted	7,539	226
Jew-fish	1,500	23
Kingfish	42,458	941
Mackerel	36,775	1,384
Perch, fresh	51,054	1,062
Perch, salted	3,000	120
Pompano	7,495	2,897
Rock-fish, fresh	163,735	4,806
Rock-fish, salted	10,000	400
Salmon, chinook	6,653,879	236,551
Salmon, silver	48,160	1,685
Salmon, blueback	19,100	668
Salmon, steelhead	113,600	3,876
Sardines	1,169,000	6,470
Sea trout	2,368	80
Sea bass, fresh	613,061	13,429
Sea bass, salted	14,000	540
Shad	402,105	5,834
Smelt	1,136,293	51,741
Striped bass	696,320	29,542
Sturgeon	129,849	7,476
Surf-fish	12,000	180
White-fish	35,000	700
Yellow-tail	10,411	232
Total	13,955,799	412,803
Seines:		
Carp	35,925	359
Cat-fish	121,311	3,565
Croakers	17,919	473
Flounders	264,306	4,648
Hardhead	31,880	1,117
Herring, fresh	36,478	902
Herring, salted	9,000	290
King-fish	6,240	135
Mullet	10,000	250
Perch	223,745	6,007
Pike	5,100	204
Pompano	5,640	1,560
Salmon, chinook	61,500	1,553
Salmon, silver	12,000	420
Salmon, blueback	2,500	87
Sardines	214,000	1,320
Shad	45,000	450
Smelt	178,956	6,323
Split-tail	46,000	920
Squid, dried	622,740	18,682
Striped bass	230,400	13,824
Sturgeon	10,130	510
Surf-fish	104,290	2,396
White-fish	1,500	30
Crabs	12,000	275
Total	2,308,560	66,300
Trammel nets:		
Albacore or tunny	20,000	300
Bonito	21,000	465
Carp	174,000	1,305
Croakers	23,000	650
Cultus-cod	5,000	100
Flounders	2,002,755	38,685
Jew-fish	15,000	225
King-fish	10,000	280
Mackerel	5,176	129
Mullet	12,000	360
Perch	150,267	3,321
Rock-fish	110,637	3,099
Salmon, chinook	55,680	2,227
Sculpin	3,000	75
Sea bass	41,320	960
Sea trout	23,000	632
Shad	690,696	8,019
Sole	32,245	645
Striped bass	307,600	18,448
Sturgeon	65,680	3,440
White-fish	2,500	63
Yellow-fin	24,000	480
Trammel nets—continued.		
Yellow-tail	37,520	$763
Crabs	334,080	7,795
Total	4,166,156	92,466
Lines, trawl and hand:		
Albacore or tunny, fresh	21,591	751
Albacore or tunny, salted	48,750	1,950
Barracuda, fresh	247,389	6,632
Barracuda, salted	155,085	6,203
Bonito, fresh	29,737	668
Bonito, salted	51,750	2,070
Carp	2,550	25
Cat-fish	66,292	1,818
Cultus-cod	25,000	840
Flounders	306,160	8,417
Jew-fish, fresh	19,500	503
Jew-fish, salted	22,500	900
Mackerel, fresh	97,715	4,342
Mackerel, salted	10,500	420
Perch	2,575	52
Pike	1,422	57
Rock-fish, fresh	891,693	27,812
Rock-fish, salted	39,830	1,631
Salmon, chinook, fresh	313,826	14,918
Salmon, chinook, salted	3,000	210
Sea bass	7,873	325
Sea trout	24,700	741
White-fish	11,800	304
Yellow-tail, fresh	27,613	518
Yellow-tail, salted	100,600	4,024
Total	2,529,451	86,131
Fyke nets:		
Carp	71,039	711
Cat-fish	267,208	7,129
Hardhead	128,262	4,475
Perch	1,844	215
Pike	9,483	378
Split-tail	85,926	1,719
Total	563,762	14,627
Paranzella nets:		
Flounders	48,000	720
King-fish	60,000	3,000
Tomcod	50,000	2,000
Total	158,000	5,720
Hoop nets:		
Cat-fish	11,100	222
Hardhead	25,740	257
Crabs	3,330,600	77,714
Total	3,367,440	78,193
Pots:		
Spiny lobsters	606,713	14,198
Shrimp nets:		
Shrimp in shells	903,375	36,135
Shrimp, dried	698,625	69,862
Shrimp shells	2,445,186	4,889
Total	4,047,186	110,886
Tongs, rakes, forks, etc.:		
Oysters, eastern	25,200,000	792,000
Oysters, native	3,600,000	75,000
Scallops	3,939	738
Clams, hard	636,534	9,087
Clams, soft	1,534,400	21,958
Mussels	364,076	3,637
Total	31,338,949	902,420
Miscellaneous apparatus:		
Abalone, dried	369,411	22,813
Abalone, shells	525,453	9,743
Algæ	35,824	896
Frogs	20,687	20,638
Sea-lion pelts	13,000	612
Sea-lion oil	5,250	210
Sea-lion trimmings		315
Terrapin	107,869	10,376
Whale oil	35,790	1,193
Other products	96,276	2,755
Total	1,209,560	69,551
Grand total	64,251,576	1,853,295

San Francisco.—This city is the headquarters of the fishery industries of the State, especially with respect to salmon, salt cod, oysters, shrimp, whale products, and fresh fish. Several millions of dollars of California capital which do not appear in this report are invested in the extensive salmon fisheries of Alaska. Within the past four years the salt codfish business has more than doubled, its products in 1895 being 2,783,550 pounds, of $83,506 value, and in 1899, 5,917,131 pounds, of $178,054 value. The cod catch is all from Alaskan waters, the fish being dressed and salted on the vessels or at shore stations near the fishing-grounds, after which they are brought to the home stations at San Francisco and placed under pickle in large vats. As the fish are needed they are taken from pickle, washed, and sun-dried on flakes, or, in unfavorable weather, dried under cover in improved hot-air drying plants. After curing they are prepared for shipment, either as whole fish with the skin on or as boneless fish with skin and bones removed. The codfish business of the Pacific coast has been of slow growth, on account of competition from the Atlantic coast and because the west-coast people have never been much accustomed to the use of salt fish. The domestic demand has increased yearly, and there is a growing trade with the Hawaiian and other islands of the Pacific.

The fresh-fish markets of San Francisco exhibit few changes. The large business here is a combination of retail and wholesale, but principally retail.

The crab fishery of San Francisco has long been of considerable importance. For years the catch was made inside of the Golden Gate, small sail or row boats being used. As crabs became scarce in the bay, the fishing was extended to outside waters. Within the past four years small gasoline boats of 5 horsepower have largely taken the place of sailboats. During 1899, 49 sailboats and 33 gasoline boats were used in the crab fisheries. The gasoline boats, with 2 men, fish 20 to 30 nets each; the sailboats average 15 nets, with 1 or 2 men. With favorable weather the crab fishery is followed all through the year. Day after day the same grounds are worked on. The grounds extend from the mouth of the harbor along the north shore about 10 miles, and the same distance along the beaches on the south. The catch is now nearly all made outside the harbor, where crabs are still plentiful and of larger size than those found in the bay. The average weight of crabs is 30 pounds to the dozen. Prices fluctuate between 40 cents and $1.25 a dozen, the average being 70 cents.

Since the introduction of gasoline boats the catch of crabs has largely increased, that of San Francisco County in 1899 being 3,664,680 pounds, valued at $85,509, as against 2,565,000 pounds in 1895, valued at $61,750, an increase of 1,099,680 pounds. Nine-tenths of the crab catch is made with hoop nets, the remainder being taken in trammel nets.

The only planted oyster beds of California are in San Francisco Bay. The leading features of the trade since the last report, in 1895, have

been a marked reduction in prices and a largely increased demand. The revival in business generally has been very beneficial to the oyster trade. Seed oysters from the Atlantic coast are planted over several hundred acres of the southern part of San Francisco Bay, adjoining the counties of San Mateo, Santa Clara, and Alameda, and here grow to good size and with fine flavor. During 1899, 87 carloads of Eastern seed oysters, of 90 to 100 barrels per carload, were planted on these beds. Of small native oysters, 30,000 bushels were received from the State of Washington, in sacks holding 90 pounds each, or about 1½ bushels. The supply is kept up by importations from Washington, which are planted in the bay until needed and then taken up and packed in small sacks holding one-half bushel each.

Eastern shell oysters are sold by the count—"standards" at $1.20, and large at $1.80, per 100. They are generally delivered in boxes holding 250 of the former and 200 of the latter, or about 1½ bushels each. Considerable business is also made of opened oysters, which are placed in tin cans, with ice between the rows of cans, and shipped to far and near places in the interior. In 1899, to supply the demand, 360,000 bushels of Eastern oysters and 30,000 bushels of native oysters were used, their value as placed on the market being $867,000.

Fresh fish, oyster, clam, shrimp, crab, and lobster business of San Francisco in 1899.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Albacore	16,560	$414	Smelt	716,000	$28,640
Barracuda	164,629	4,939	Striped bass	1,076,546	53,827
Bonito	8,169	490	Sole	110,872	2,772
Carp	174,000	1,305	Sturgeon	189,758	8,539
Cat-fish	28,138	1,218	Suckers	53,462	267
Cultus-cod	132,890	3,322	Squid	15,580	234
Flounders	3,090,255	61,805	Tomcod	375,538	11,266
Hake	7,210	144	Trout (brook)	27,029	6,757
Halibut	695,062	17,276	Trout (lake)	38,374	4,605
Herring	1,524,000	22,860	Other fish	19,249	569
King-fish	68,500	1,712	Clams	1,765,935	28,916
Mackerel	60,964	1,524	Crabs	3,664,680	85,509
Mullet	2,856	192	Oysters (Eastern)*	25,200,000	792,000
Perch	147,294	5,894	Oysters (native)†	3,600,000	75,000
Pike	10,906	218	Spiny lobsters	187,695	5,630
Pompano	5,032	1,761	Caviar	6,768	1,015
Rock-fish	770,480	23,114	Octopus	7,474	149
Salmon	3,113,261	124,530	Mussels	344,400	3,440
Sardines	1,328,000	13,280	Terrapin	105,987	10,094
Sea bass	335,991	8,300	Frogs	20,258	20,258
Shad	679,177	13,584			
Skates	13,571	203	Total	49,902,550	1,447,572

*360,000 bushels. †60,000 bushels.

The following table shows the amount and value of the latest introduced fish received at San Francisco:

Species.	1899.		1900.	
	Lbs.	Value.	Lbs.	Value.
Striped bass	1,076,546	$53,827	1,251,202	$62,560
Shad	679,177	13,584	620,891	13,970
Carp	174,000	1,305	133,469	1,335
Cat-fish	28,138	1,218	24,378	1,036
Total	1,957,861	69,934	2,029,940	78,901

The whale fishery continues to show a decrease in the number of vessels engaged. The business of 1899 was the most satisfactory for several years, having fewer disasters and larger returns. With ten less vessels engaged than in 1895, the receipts of 1899, when compared with that year, show a gain of 96,206 pounds of whalebone, 26,540 gallons of sperm oil, and 5,263 gallons of whale oil, the gain in the value of products taken in 1899 over those of 1895 being $108,482.

The fleet of 1899 comprised ten steamers and six sailing vessels belonging in San Francisco, and one steamer and five sailing vessels of New Bedford with headquarters in the former city. The San Francisco vessels captured 101 bowhead, 7 right, and 6 sperm whales; the New Bedford vessels took 14 bowhead, 10 right, and 103 sperm whales.

Some of the vessels were quite fortunate, the steamer *Beluga* leading, with 32 bowhead whales, that yielded 53,000 pounds of whalebone; the steamer *Jeannette* being next, with 18 bowhead whales and 33,400 pounds of whalebone. Others were less fortunate, some having very little bone or oil.

The following table shows the decrease in the number of vessels during recent years:

Home port.	1892.	1895.	1899.
San Francisco	36	22	16
New Bedford	21	10	6
Total	57	32	22

The statistics of the whale fleet having headquarters at San Francisco in 1899 are as follows:

Home port.	No.	Tonnage.	Value.	Value of outfit.	Advances to crew.	No. of crew.
San Francisco	16	4,416	$575,000	$374,000	$57,560	638
New Bedford	6	1,951	89,000	85,000	20,900	247
Total	22	6,367	664,000	459,000	78,460	885

Home port.	Products.									
	Whalebone.		Sperm oil.		Whale oil.		Trade bone.		Trade furs.	Total value of products.
	Lbs.	Value.	Galls.	Value.	Galls.	Value.	Lbs.	Value.	Value.	
San Francisco	201,225	$425,550	9,633	$3,625	53,235	$15,373	6,167	$10,722	$3,422	$458,692
New Bedford	36,500	69,875	84,892	32,189	53,077	15,923	.....	.....	.....	117,987
Total	237,725	495,425	94,525	35,814	106,312	31,296	6,167	10,722	3,422	576,679

Del Norte County.—The fisheries of this county are not of much importance except to the ranchers and Indians living near Smith or Klamath rivers. Smith River enters the Pacific near the Oregon border line. A cannery here has been idle for several years. During 1899 there was only a light run of salmon in Smith River; the catch was salted and amounted to 24,000 pounds. The single cannery near the mouth of Klamath River packed 1,600 cases of salmon, using

112,000 pounds of fish, which represented the catch of the Klamath, except that taken by ranchers and Klamath Indians for their own use.

Humboldt County.—For several years the fisheries of this county have declined both in the number of fishermen, fishing apparatus, and products. In 1895 the fishermen numbered 376, in 1899 only 185; the products those years being as follows:

Species.	1895.		1899.	
	Lbs.	Value.	Lbs.	Value.
Salmon, chinook	277,325	$8,320	176,100	$5,189
Salmon, silver	136,413	4,092	60,160	2,105
Salmon, blueback			21,600	755
Salmon, steelhead	409,237	16,370	113,600	3,876
Flounders	57,000	1,030	75,200	1,504
Smelt	30,000	600	81,000	2,430
Rock-fish	35,000	525	20,000	600
Herring	20,000	100	39,000	990
Perch	20,000	300	26,000	490
Other fishery products	162,400	2,124	91,500	6,375
Total	1,147,375	33,461	704,160	24,314

The salmon fisheries are of chief importance, their decrease, as above shown, being 451,515 pounds. The fishermen attribute the decrease largely to a close season in 1899, from February 1 to May 1, on steelhead, and from September 11 to October 15 on salmon. In 1899 the steelhead catch was all made in January; the salmon catch in October, November, and December.

The fisheries of the county are chiefly on the lower end of Eel River, with some on Elk and Mad rivers and in Humboldt Bay. For several years a cannery and saltery on Eel River canned a large amount and salted several thousand barrels of salmon yearly. During the past few years no salmon have been canned or salted; after supplying the local demand the surplus is sent to fresh-fish firms in San Francisco.

The continued decrease in the salmon fisheries of Eel River has been offset to some extent by close-season laws and artificial propagation. These agencies have proved beneficial, and fish were more plentiful in 1900 than at any time since 1895. The fishermen receive $40 per month and their board, their catch in the rivers being made with haul seines and gill nets. A small amount of fishing in the bay supplies the local demand with halibut, smelt, herring, perch, rock-fish, cultus-cod, clams, and crabs.

Marin County.—The fisheries of this county are represented by the cod-drying stations at Pescada Landing and California City, Chinese shrimp camps at San Quentin and Point Pedro, and general fisheries in Tomales Bay. The total fishery products amounted to 2,323,060 pounds of $64,495 value. Over half of this amount was shrimps taken by Chinese. The Tomales Bay fisheries are noted for the yield of clams at all seasons, and for herring, smelt, sardines, and sea bass in their seasons. The fishermen send their products to the San Francisco market. During 1899 fish were very plentiful in both Tomales

and San Francisco bays; prices dropped so low that little was left the shipper after charges were paid, the market being amply supplied direct from San Francisco vessels and boats at the wharf; shipments from points dependent on the railroads largely decreased, those from Marin County falling to about one-half those of 1895.

Santa Cruz County.—The fisheries of this county are carried on from Santa Cruz and Capitola, the catch being made in Monterey Bay. As compared with 1895 there are few changes of note. The products show some falling off in quantity, caused by a smaller number of fishermen being engaged. The principal item of decrease was 134,325 pounds in the catch of sea bass.

Localities occupied long by fishermen have of late years become more valuable, and high rents have compelled them to look elsewhere, but their places are largely filled by tourists and sportsmen who find great sport in trolling for salmon during June, July, and August; at times 60 boats were thus engaged, the salmon catch by hook and line being 85,340 pounds. The salmon taken were all chinook, which refuse the hook or food after entering fresh-water streams. Monterey Bay appears to be the southern limit of migration for the salmon and shad. Seldom is a single specimen of either seen south of this bay, and at no other place on the Pacific coast do professional fishermen use hooks and lines in the salmon fisheries.

An increased demand with enhanced prices has fully made up in values the losses from a decreased catch. A large local demand is supplied with a good variety of the best food-fishes found on the coast; any surplus is forwarded by express to San Francisco.

Monterey County.—The fisheries of Monterey County embrace a large number of species of fine food-fish, also abalones, clams, mussels, squid, shark-fins from the sea, and frogs from the shore; to these are added whales, sea lions, starfish, sea-urchins, and algæ.

The products of 1895 amounted to 1,109,786 pounds of $20,406 value. As compared with these figures the product of 1899 show a gain of over 100 per cent in weight and 400 per cent in value as follows:

Items.	Pounds.	Value.
Fresh fish	1,346,783	$45,792
Dry and pickled fish	209,199	10,224
Miscellaneous products	899,830	24,805
Total	2,455,812	80,821

Of the fresh fish products 441,180 pounds were peddled through the interior, and 905,583 pounds expressed to the San Francisco market. The dry and pickled fish, 100,824 pounds, with 622,740 pounds of dry squid, had a distribution extending to Honolulu, Japan, and China.

The Japanese follow the abalone fishery, in which divers with diving

suit, air pumps, and accessories are used off the rocky shores of Monterey Bay, the products amounting to 108,375 pounds of dry abalone meat and 63,293 pounds of abalone shells. Abalone meat, dried, is sold to the Chinese of the United States and China; the shells are sold to tourists, to button and fancy-work factories, and to some extent in Europe.

The Chinese have for many years been the exclusive fishermen for squid, which are taken in small-sized purse seines used just abreast of their camp. This catch, dried and ready for shipment amounted to 622,740 pounds of $18,682 value.

The whale fishery was followed by 8 Portuguese and 8 Japanese, who use whale boats to pursue passing whales, which on being killed are towed to shore stations and there cut up and the oil extracted.

Of late years quite a business has sprung up in the capture of sea lions alive, which are sold for exhibition purposes and to zoological parks of this country and Europe. Thirty-seven sea lions were taken by the fishermen of Monterey County and so disposed of in 1899.

The frugal Chinese and Japanese seldom reject any food products from the sea, as will be noticed in the saving of 9,065 pounds of starfish and sea urchins, 35,824 pounds of algæ, and 74,421 pounds of bones of whales. The first two are cleaned and prepared for sale to tourists and collectors of sea products. Algæ are dried and used by the Chinese for many purposes, including food, medicine, and fertilizing. The bones of whales killed near Monterey and those found on the beaches along the coast are shipped to San Francisco and there ground up for fertilizing purposes.

The salmon fishery is of comparatively late date. The fishermen were led into it from seeing the success of sportsmen trolling with spoon hooks. In 1892 they secured in this way 6,915 pounds; in 1895, 94,475 pounds, and in 1899 the catch by hooks and lines amounted to 227,486 pounds. These salmon are all chinook and are taken only in May, June, July, and August. The catch is sold locally.

San Luis Obispo County.—The fisheries of this county present no changes of note in the kinds or quantity of products handled. A few fishermen at Port Harford supply the surrounding country with fresh fish; the surplus is sent to San Francisco. The aggregate products of 1899 amounted to 252,255 pounds of fresh fish, 30,810 pounds of salt fish, and 58,265 pounds of other fishery product, the total value being $12,713; 175 sea lions were shot for their oil and hides.

Santa Barbara County.—Nearly every fishing station between San Francisco and San Diego shows quite large gains in the fisheries, Santa Barbara being an exception. Fish are plentiful in Santa Barbara channel and around the islands, yet the local demand for fish is only poorly supplied. The few fishermen work with little energy and only part of the time. The products of the fisheries in 1899 amounted to 655,893 pounds of $15,597 value. This includes 168,746 pounds

of fresh fish, sold locally; 332,427 pounds of spiny lobsters, most of which were shipped to San Francisco; 56,125 pounds of abalone meat, and 96,635 pounds of abalone shells. These amounts have varied but little from year to year during the past ten years.

Sea lions are numerous around the several islands of Santa Barbara County, but they have very little commercial value. Each season a number of them are captured alive by lassoing them as they leave the rocks for the water. The capture of sea lions from small open boats is exciting and dangerous. The animals make a hard fight for freedom, but after being severely choked they are dragged ashore and placed in strong boxes for shipment. The demand for sea lions is small, and prices have declined from $50 each to as low, in some cases, as $10. Of those captured in 1899, five weighing 1,180 pounds were sent by express to the Atlantic coast. Seven yearlings of 780 pounds aggregate weight were shipped to Pacific Grove, Monterey County, to be tamed for exhibition purposes.

BULL'S-EYE OR CHUB MACKEREL (*Scomber colias*).

Los Angeles County.—The several reports on the Pacific coast fisheries by the U. S. Fish Commission since 1889 have called attention to the opportunities for a large increase in the fisheries of this section, and an increase is now shown by the following account of the aggregate yield of fishery products: 910,531 pounds in 1889; 1,155,168 pounds in 1892; 2,905,988 pounds in 1895; 3,960,062 pounds in 1899.

The fisheries are carried on from small boats used near the several fishing stations of the county. The products are mostly shipped by express to Los Angeles, a small amount being used for the home demand. The weights as shown are largely from the books of the railroad and express companies.

The several fish stations of the county, and the amount of the fishery products of each in 1899, were as follows: San Pedro, 2,690,000 pounds; Redondo, 630,890; Santa Monica, 144,666; Wilmington, 120,939; Long Beach, 136,333; Clementus, 137,234; minor stations, 100,000; a total of 3,960,062 pounds. The value to the fishermen amounted to $82,371, the increase over the business of 1895 being 1,054,074 pounds, worth $27,506.

The capital invested in the fisheries amounted to $113,356, with 198 fishermen and 100 shoresmen employed. Sardines comprise about one-fourth of the products. This is the only branch of the fisheries in which vessels are used. The catch is made with purse seines. Since the introduction of California sardines their superior quality has caused a steadily improved demand. During 1899 the pack of the cannery at San Pedro amounted to 13,000 cases, of which 5,000 cases were one-quarter and 3,000 cases one-half flat, packed in olive oil, spices, and mustard; the remainder, 4,500 cases in one-pound tall and 500 cases in two-pound tall cans, were labeled mackerel. Nearly all of the sardine catch is canned.

With the exception of sardines used in canning, the products of the fisheries were disposed of fresh. Bastard halibut (*Paralichthys californicus*) which are included with flounders in the accompanying statistics for California, furnished 1,080,463 pounds, or about one-third of the quantity sold fresh. The demand for this fish always exceeds the supply. It is sold under the name of halibut, and weighs from 10 to 30 pounds. In 1899 gill nets were first used in the fishery for this species, the nets being set on the bottom. Proving a decided success, they soon came into general use. Trawls and hand lines are also used, but gill nets are preferred for bastard halibut, on account of no bait being required. In this fishery the catch by gill nets was fully as large as that taken previously by trawls.

California is the only part of the United States in which the abalone fishery is prosecuted. The abalone is taken exclusively by Chinese and Japanese, and its consumption is mainly by those races. This fishery is located 4 miles northwest from San Pedro, at the extreme southern end of Los Angeles County. The camp has an American superintendent, with 20 Japanese, 9 of whom comprise the fishery party, the others working on shore. At this point the shore is rough and rocky, the abalones being found attached to the rocks, from which they have to be removed by the use of a stout chisel. The products in 1899 amounted to 60,000 pounds of dried abalone and 30,000 pounds of shells, of $7,800 value.

This catch was made by divers without armor in from 20 to 25 feet of water. The apparatus used is simple and inexpensive; a small keg is anchored over the abalone bed; to this a netted bag is attached to receive the catch, the buoy simply being used by the divers to support them for a very brief rest between dives, at which time any abalones brought up are placed in the netted bag. The taking of abalones by diving is of a comparatively late date. The abalone fishery is the only one in the United States in which diving armor is used.

A head diver is paid from $75 to $100 per month; an assistant who acts as diver when necessary, from $60 to $75 per month; head curer, $50 per month; all others, $20 per month. In addition to these wages the men receive their board and lodging at the camp. The diving

armor with air pump came into use in 1900. Divers in armor work throughout the year in from 20 to 75 feet of water, when the weather is favorable. The diver takes down with him a netted bag into which he puts the abalones as he pries them from their rocky attachment. When the bag is filled it is hauled up on signal, emptied into the anchored boat, and returned to the diver. Divers work a full day, remaining below as long as two hours at a time.

As soon as the abalones are received at camp they are taken from their single shell and all refuse matter removed. The meat or solid portion is then prepared for market as follows: After washing, it is placed in a weak salt pickle overnight. In the morning it is removed, washed, and boiled for a few moments, then placed on trays, each tray holding an average of 100 abalones. These are exposed to the sun and air for half a day and are then placed in a smokehouse for three hours,

BLACK-BANDED ROCK FISH (*Sebastichthys nigrocinctus*).

charcoal being used in the smoking. They are next given a second boiling for half an hour, when they are again placed on trays and exposed for two to three weeks in drying. Finally they are placed in lukewarm water for two to three hours and then given two weeks' drying, which leaves them very hard and solid. The meat is cleaned and packed in cases lined with parchment paper to exclude moisture, the cases holding 200 pounds each. Only the best shells are saved.

As the abalone comes from the water the shell and soft parts are of about equal weight, one-half of the latter being waste. As finally cured, only 10 pounds of meat is produced from 100 pounds of shells and meat fresh, a shrinkage of about 90 per cent.

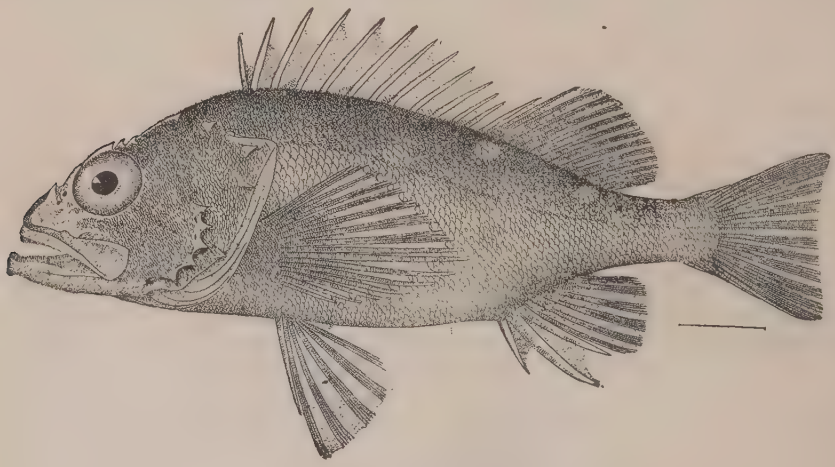
In San Diego County the preparation of abalone meat here consists simply in boiling the abalones once for two to three hours in sea water. After the one boiling they are sun-cured for several weeks

and then packed in bags and shipped to San Diego; at the latter port commission firms forward them to San Francisco and direct to China.

The Mexican mode of preparation of abalone meat is still more simple. The meat, after being cleaned of all offal and washed, receives three cuts which lay it open but do not detach the several parts. It is next spread out for drying without any salt or other preparation. This meat, after drying, is very white, as when first taken from the shell. At other places where abalones are salted and smoked they take on a more or less dark color.

While drying, abalones are repeatedly turned until cured hard.

The clams and spiny lobsters of Los Angeles County are much in demand, and several attempts have been made to can them. On page 646 of the report of this Commission for 1896 an account is given of the canning of the *Donax californicus*, a very small clam, some three-



CORSAIR (*Sebastichthys rosaceus*).

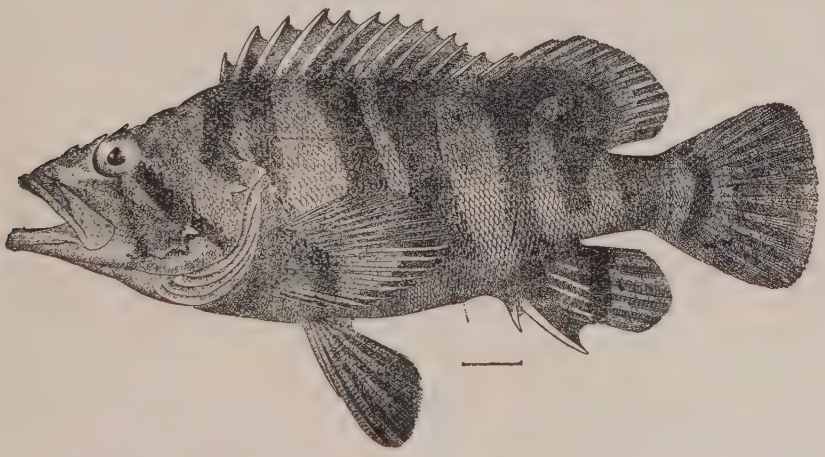
fourths of an inch long. These clams were very abundant on the shores of Long Beach, but the supply was soon exhausted. During 1899 another firm for a short time canned the large-sized hard-shell clams obtained on the beach, being found quite deep in the sand, from which they were taken at low tide. The supply was so limited that the cannery was discontinued after packing a few hundred cases. The cannery paid 60 cents per 100 pounds for clams in the shell. From 175 pounds 12 gallons of nectar and 2½ gallons of clam meat were produced. The nectar was packed in pound cans; the refuse was sold as poultry food, being packed in gallon cans. Large and small sized hard-shell clams are more or less plentiful in the several beaches of the county. The near-by ranchers as well as regular fishermen take in the aggregate quite a large amount, that are sent to the dealers of Los Angeles. About 1 ton a week is sent to the city during the year. The clam men receive 1½ cents a pound for small clams, locally known

as cockles, and 1 cent a pound for the large size. Clams are teamed from Redondo, Long Beach, Bologna, and other beaches.

The supply of spiny lobsters never fills the demand. Two small canneries were for a time operated at San Pedro in 1899, in which 118,000 pounds of lobsters in the shell were used. A small quantity was canned at Los Angeles during 1899 and 1900, but until the supply is largely increased the canning of spiny lobsters will be limited.

Redondo is one of the important fishing stations of the county, from which the business is carried on in small boats. Trawls and gill nets are used for some 6 miles north and the same distance south from the home station, and 2 to 6 miles from shore. The catch includes bastard halibut, flounders, sea bass, yellow-tail, jew-fish, and barracuda.

Of the several fishing stations of Los Angeles County, San Pedro is the most important. The shipments from that port in 1899 com-



TREE-FISH (*Sebastichthys serriceps*).

prised 1,621,710 pounds of fresh fish, 12,622 cases of sardines, 1,639 cases of lobsters, and 90,000 pounds of abalone meat and shells.

In past years quite an amount of the products were dry and pickle-cured. The fresh-fish demand has supplanted the cured-fish business at this port, the shipments of dry fish being only 1,590 pounds. The following statement of shipments by the Wells-Fargo Express Company is of interest not only in showing the extent of the fresh-fish business, but the recent wide distribution:

Destination.	Lbs.	Destination.	Lbs.
Los Angeles	931,635	Oklahoma	5,220
Other local points	241,665	Missouri	4,000
San Francisco	251,530	Minnesota	60
Arizona	64,965	Illinois	620
New Mexico	18,385	Indian Territory	560
Texas	32,565	Iowa	50
Colorado	28,385	Utah	320
Kansas	33,170		
Nebraska	8,580	Total	1,621,710

Orange County.—The fisheries are represented in this county by 34 fishermen at and near Newport. The aggregate products were 355,417 pounds, the total value being $8,648. Among the numerous species taken were 89,910 pounds of halibut, 68,607 pounds of rock-fish, and 46,000 pounds of barracuda.

San Diego County.—The fisheries of this county show few changes. The total products in 1895 were 1,374,491 pounds, valued at $27,951, as against 1,655,950 pounds in 1899, valued at $55,315. The gain of 281,459 pounds and $27,364 in value was chiefly from an increase in the abalone fishery and enhanced values received for all fishery products. Of the products of 1899, 626,629 pounds were sold as fresh fish and 489,000 pounds as dry and pickled fish. These amounts vary but little from year to year. The fresh-fish values include 17 species, of which barracuda led with 154,754 pounds, followed by rock-fish, 135,797 pounds, and bastard halibut, 125,797 pounds. These three species comprise two-thirds of the total sales of fresh fish. Of dry and pickled fish nearly half consisted of barracuda, the remainder being yellow-tail, albacore, bonito, rock-fish, mackerel, and jew-fish.

The capital in the fisheries amounted to $32,190, and 175 fishermen and 6 shoresmen were employed.

Shipments of fresh fish by Wells-Fargo Express amounted to 371,552 pounds. Of this amount one-half went to local points in southern California, one-fourth to San Francisco, and the remainder to Arizona and New Mexico, with small shipments to Colorado and Kansas. The dry and pickled fish find a market in San Francisco, among its foreign population, with some shipments to Honolulu.

The spiny-lobster catch increased from 30,000 pounds in 1895 to 61,000 pounds in 1899. The distribution extended to Denver, Colo., San Antonio and Dallas, Tex., the City of Mexico, and as far east as Minneapolis, Minn. With an ample supply of spiny lobsters their shipment would be an important feature of the fisheries.

The abalone fishery shows an increase of 385,761 pounds of abalone meat and shells and an increase in value of $11,795 from that of 1895. This increase has been from three camps of American fishermen at and near Turtle Bay, off the Mexican coast, where they have concessions from the Mexican Government. The abalones were mostly taken by hand picking at low tide, one diving outfit being used by the three camps.

The shells find a market to some extent in France and Germany, where they are made into large buttons and also used by manufacturers of fancy boxes and toilet articles. The large, fine shells find a market in the United States, being polished and sold for ornaments.

STATISTICS

OF THE

FISHERIES OF THE GREAT LAKES.

PREPARED IN THE DIVISION OF STATISTICS AND METHODS OF THE FISHERIES, UNITED STATES FISH COMMISSION.

C. H. TOWNSEND, Assistant in Charge.

INTRODUCTORY NOTE.

The statistical report on the fisheries of the Great Lakes presented herewith is based upon original investigations by trained agents of this Commission. The inquiries were begun at the opening of the fishing season in 1900 and the information collected relates to the year 1899. Upon the completion of the field work the general results were made public in Statistical Bulletin No. 17, which was distributed among persons interested in the fisheries of the lake region. It was issued also in less condensed form in the report of the Commissioner for the year ending June 30, 1901. Since then the information has been further arranged in the office and the results are now given.

The report has been prepared under the direction of Mr. C. H. Townsend, assistant in charge of the Division of Fisheries.

The field inquiries were conducted as follows: Mr. T. M. Cogswell canvassed Lake Superior; Messrs. C. H. Stevenson and E. S. King, Lake Michigan; Mr. W. A. Roberts, lakes Huron and St. Clair and the St. Clair and Detroit rivers; and Mr. J. N. Cobb, lakes Erie and Ontario.

Mr. J. B. Wilson collected information on the wholesale fishery trade of Lake Erie.

Most of the field agents have assisted in the office work and contributed notes relative to the fisheries.

The assistant in charge has had the constant aid of Mr. Ansley Hall and other persons in the office.

GEORGE M. BOWERS,
Commissioner.

STATISTICS OF THE FISHERIES OF THE GREAT LAKES.

GENERAL NOTES AND STATISTICS.

The number of persons engaged in the commercial fisheries of the Great Lakes in 1899 was 9,670. By far the greater proportion of these (6,657) were engaged in the shore or boat fisheries. There were employed on vessels fishing 1,156; on vessels transporting, 92; the remainder, 1,765, being shoresmen. The lakes whose fisheries employed the greatest numbers were Erie and Michigan, there being 3,728 engaged in the former and 3,255 in the latter. The numbers employed in the fisheries of other lakes were as follows: Huron, 1,241; Superior, 613; St. Clair, 442; Ontario, 391. Since the last general canvass of the fisheries of the Great Lakes, in 1893, there has been a decrease of 510 in the number of persons employed, the principal decrease in this respect being in Lake Michigan.

The amount of capital invested in the fisheries of these lakes was $6,617,716. The investment in Lake Michigan was $2,915,241; in Lake Erie, $2,720,554; in Lake Huron, $474,953; in Lake Superior, $372,083; in Lake Ontario, $80,350; and in Lake St. Clair, $54,535. As compared with 1893 the capital invested has increased $718,446. There has been an increase in the investment in Lake Michigan of $851,744; in Lake Erie, $213,712; and in Lake Ontario, $24,219. The investment in the fisheries of the other lakes has decreased as follows: Lake Superior, $156,941; Huron, $28,747; St. Clair, $185,541.

The number of fishing and transporting vessels employed was 208, having a value, exclusive of outfits, of $659,650. These were employed chiefly in the fisheries of lakes Michigan and Erie, and in nearly equal numbers in each. The boats in the shore fisheries numbered 3,281, valued at $227,766. The principal apparatus of capture used on vessels and boats was gill nets, valued at $690,518, the next most important forms of apparatus being pound and trap nets, valued at $660,408.

The value of shore and accessory property in the fisheries and fishery industries was $2,225,503, and the cash capital amounted to $1,933,600.

The products of the fisheries aggregated 113,727,240 pounds, valued at $2,611,439. Lake Erie produced 58,393,864 pounds, valued at $1,150,895; Lake Michigan, 34,499,996 pounds, valued at $876,743; Huron, 12,418,327 pounds, valued at $308,078; Superior, 5,429,654 pounds, valued at $150,862; Ontario, and the St. Lawrence and Niagara rivers, 2,406,332 pounds, valued at $100,997; and St. Clair, and the St. Clair and Detroit rivers, 579,067 pounds, valued at $23,864.

Some of the more important species yielded by the fisheries were herring, 59,913,576 pounds, valued at $941,067; lake trout, 10,611,588 pounds, valued at $431,276; yellow perch, 9,584,802 pounds, valued at $156,350; white-fish, 5,094,014 pounds, valued at $297,023; blue pike,* 4,731,782 pounds, valued at $148,740; wall-eyed pike,* 3,311,892 pounds, valued at $156,503; sturgeon, 1,129,348 pounds, valued at $81,085. Other species of less value, but taken in comparatively large quantities, were suckers, 4,043,987 pounds, valued at $56,068, and carp, 3,674,346 pounds, valued at $52,362.

The following reports relative to the fisheries of the Great Lakes may be consulted advantageously in the present connection.

The Fisheries of the Great Lakes, by Frederick W. True, elaborated from notes gathered by Mr. Ludwig Kumlein. <The Fishery Industries of the United States, 1887, Section II, pp. 631–673.

The Fisheries of the Great Lakes, by Ludwig Kumlein. <The Fishery Industries of the United States, 1887, Section V, vol. I, pp. 755–769.

Report on an Investigation of the Fisheries of Lake Ontario, by Hugh M. Smith, M. D. Bull. U. S. Fish Com. 1890, pp. 177–215.

Review of the Fisheries of the Great Lakes in 1885, compiled by Hugh M. Smith and Merwin-Marie Snell, with introduction and description of fishing vessels, by J. W. Collins. Rept. U. S. Fish Com. 1887, pp. 1–333.

The Fisheries of the Great Lakes, by Hugh M. Smith. Rept. U. S. Fish Com. 1892, pp. 361–462.

Fisheries of the Great Lakes, by Hugh M. Smith. Rept. U. S. Fish Com. 1895, pp. 93–103.

Report of the Joint Commission relative to the Preservation of the Fisheries in Waters contiguous to Canada and the United States, by Richard Rathbun and William Wakeham. House Ex. Doc. No. 315, Fifty-fourth Congress, second session, 1897, pp. 1–178.

Fisheries of Lake Ontario. <Rept. U. S. Fish Com. 1898, pp. CLII–CLVI.

Statistics of Certain Fisheries of the New England and Middle Atlantic States and the Great Lakes. <Rept. U. S. Fish Com. 1898, pp. CLXVI–CLXXV. In this report the figures presented relate to the fiscal year 1897.

STATISTICS.

In the present report of the fisheries of the Great Lakes for the year 1899 the statistics are first shown by lakes in a series of tables for the whole region. The fisheries of each lake are then considered in detail by States and counties, the products of the vessel and shore fisheries being shown by species for each form of apparatus.

The quantity and value of caviar prepared by the fishermen of the various lakes and extent of the wholesale fishery trade in some of the more important localities are given in separate statistical statements; but these data are not to be added to the totals of the regular tables.

Comparative statistics for certain years from 1880 to 1899, and a series of tables in which the fisheries are considered primarily by States, are also introduced.

In all tables relating to products the fresh fish are entered at round weight, as when taken from the water. With regard to the sturgeon, which is one of the species so treated, a part of the catch is sold round and the remainder dressed, while a considerable quantity of the eggs

*The wall-eyed pike (*Stizostedion vitreum*), the variety of wall-eyed pike known locally as blue pike, and the sauger (*Stizostedion canadense*), are classified in the accompanying statistics under the general term "pike perch."

of the females is salted and disposed of as caviar. The weight and value given for sturgeon, therefore, include both the meat and the caviar. The weight for smoked and salted fish represents the condition in which they are marketed.

Following are three general tables showing, by lakes, the number of persons employed, the apparatus and capital, and the quantity and value of the products.

Table showing the number of persons employed in the fisheries of the Great Lakes in 1899.

How employed.	Superior.	Michigan.	Huron.	*St. Clair.	Erie.	†Ontario.	Total.
On vessels fishing	67	453	62	.....	574	.....	1,156
On vessels transporting	5	10	7	.....	65	5	92
In shore or boat fisheries	478	2,045	986	374	2,401	373	6,657
Shoresmen	63	747	186	68	688	13	1,765
Total	613	3,255	1,241	442	3,728	391	9,670

*Includes St. Clair and Detroit rivers. †Includes St. Lawrence and Niagara rivers.

Table showing, by lakes, the apparatus and capital employed in the fisheries of the Great Lakes in 1899.

Items.	Superior.		Michigan.		Huron.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	9	$38,800	76	$210,300	9	$42,500
Tonnage	259	.....	1,214	.....	157	.....
Outfit	.....	8,504	.....	40,695	.....	7,715
Vessels transporting	1	3,000	4	3,700	3	4,250
Tonnage	18	.....	107	.....	99	.....
Outfit	.....	1,300	.....	210	.....	580
Boats	305	27,245	1,098	67,968	527	40,835
Apparatus—vessel fisheries:						
Pound nets	.....	.....	10	2,040	35	525
Gill nets	3,273	42,364	28,940	202,862	2,266	27,720
Lines	.....	.....	.....	480	.....	.....
Apparatus—shore fisheries:						
Pound nets and trap nets	162	25,820	795	184,309	961	111,314
Gill nets	3,956	56,919	20,917	85,533	3,410	26,664
Seines	1	50	11	510	9	673
Fyke nets	15	150	1,477	23,627	398	7,632
Lines	.....	588	.....	2,678	.....	346
Other apparatus	.....	320	.....	2,500	.....	210
Shore property	.....	111,023	.....	869,629	.....	148,489
Cash capital	.....	56,000	.....	1,218,200	.....	55,500
Total	.....	372,083	.....	2,915,241	.....	474,953

Items.	*St. Clair.		Erie.		†Ontario.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	.....	.....	85	$281,400	.....	.....	179	$573,000
Tonnage	.....	.....	1,247	.....	.....	.....	2,877	.....
Outfit	.....	.....	.....	70,881	.....	.....	.....	127,795
Vessels transporting	.....	.....	19	74,700	2	$1,000	29	86,650
Tonnage	.....	.....	418	.....	22	.....	664	.....
Outfit	.....	.....	.....	12,996	.....	90	.....	15,176
Boats	188	$3,770	876	79,466	287	8,482	3,281	227,766
Apparatus—vessel fisheries:								
Pound nets	.....	.....	.....	.....	.....	.....	45	2,565
Gill nets	.....	.....	29,018	160,870	.....	.....	63,497	433,816
Lines	.....	.....	.....	.....	.....	.....	.....	480
Apparatus—shore fisheries:								
Pound nets and trap nets	5	1,050	1,724	329,500	145	5,850	3,792	657,843
Gill nets	60	600	12,660	68,312	1,187	18,674	42,190	256,702
Seines	13	1,255	104	8,390	24	420	162	11,298
Fyke nets	.....	.....	617	15,750	451	5,412	2,958	52,571
Lines	.....	644	.....	3,470	.....	1,355	.....	9,081
Other apparatus	.....	271	.....	142	.....	427	.....	3,870
Shore property	.....	26,945	.....	1,050,977	.....	18,440	.....	2,225,503
Cash capital	.....	20,000	.....	563,700	.....	20,200	.....	1,933,600
Total	.....	54,535	.....	2,720,554	.....	80,350	.....	6,617,716

*Includes St. Clair and Detroit rivers. †Includes St. Lawrence and Niagara rivers.

Table showing, by lakes and species, the yield of the fisheries of the Great Lakes in 1899.

Species.	Superior.		Michigan.		Huron.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass			8,565	$644	5,659	$396
Cat-fish and bullheads	7,600	$304	62,162	1,682	574,406	16,627
Eels			484	40	861	49
Fresh-water drum			55,372	722	160,646	1,009
German carp			25,280	492	6,369	143
Herring, fresh	886,018	6,954	10,225,653	221,784	1,073,957	10,696
Herring, salted	239,460	4,816	11,348,063	212,245	2,625,850	49,722
Ling or lawyers			122,339	886	20,880	167
Pike and pickerel	15,602	316	87,316	4,490	191,751	6,995
Pike perch (wall-eyed)	13,679	495	173,733	7,555	1,110,516	49,294
Rock bass	934	28	4,161	43	83,344	1,612
Sturgeon	4,415	176	108,279	7,187	30,497	1,268
Suckers, fresh	5,447	57	934,642	10,143	980,695	18,502
Suckers, salted	6,200	114	109,136	1,931	126,795	1,818
Sun-fish					61,062	739
Trout, fresh	2,664,838	85,572	5,407,110	241,015	1,879,411	80,077
Trout, salted	453,331	15,127	81,837	3,666	7,690	346
White bass			4,380	146		
White-fish, fresh	647,670	23,710	1,407,142	68,025	584,168	31,525
White-fish, salted	45,521	1,837	103,222	5,467	8,140	385
White-fish (blucfin)	435,060	11,317	498,318	12,794		
White-fish (Menominee), fresh			375,053	9,747	112,417	2,667
White-fish (Menominee), salted			144,030	4,560	24,060	810
Yellow perch	3,879	39	3,077,741	57,972	2,740,669	32,690
Other fish			117	9	484	21
Crawfish			135,861	3,498		
Frogs					8,000	520
Total	5,429,654	150,862	34,499,996	876,743	12,418,327	308,078

Species.	*St. Clair.		Erie.		†Ontario.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	200	$14	133,746	$9,866	48,046	$3,133	196,216	$14,053
Cat-fish and bull-heads	17,505	629	1,002,704	30,451	518,423	18,834	2,182,800	68,527
Crappie			60,000	1,800			60,000	1,800
Eels			849	61	123,840	6,163	126,034	6,313
Fresh-water drum	17,050	131	1,147,122	7,651			1,380,190	9,513
German carp	8,000	221	3,633,697	51,456	1,000	50	3,674,346	52,362
Herring, fresh			33,427,797	431,037	61,178	2,789	45,674,603	673,260
Herring, salted					25,600	1,024	14,238,973	267,807
Ling or lawyers							143,219	1,053
Mooneye			43,836	867			43,836	867
Pike and pickerel	42,365	1,795	19,625	1,241	100,365	5,861	457,024	20,698
Rock bass	3,700	217	5,296	91	102,968	2,323	200,403	4,314
Sturgeon	7,600	1,352	789,402	53,392	189,155	17,710	1,129,348	81,085
Suckers, fresh	33,600	325	1,568,734	18,077	278,738	5,101	3,801,856	52,205
Suckers, salted							242,131	3,863
Sun-fish	250	4	175,440	4,362	148,449	2,099	385,201	7,204
Trout, fresh	69,915	2,884	32,024	1,736	15,432	853	10,068,730	412,137
Trout, salted							542,858	19,139
Pike perch (wall-eyed)	268,350	11,877	1,735,174	86,455	10,440	827	3,311,892	156,503
Pike perch (blue pike)			4,544,786	139,301	186,996	9,439	4,731,782	148,740
Pike perch (sauger)			3,026,565	75,313			3,026,565	75,313
White bass			1,596,524	30,603	2,300	92	1,603,204	30,841
White-fish, fresh	69,902	3,087	2,066,314	152,009	161,935	10,978	4,937,131	289,334
White-fish, salted							156,883	7,689
White-fish (blucfin)							933,378	24,111
White-fish (Menominee), fresh							487,470	12,414
White-fish (Menominee), salted							168,090	5,370
Yellow perch	10,000	1,202	3,315,496	52,625	407,017	11,822	9,584,802	156,350
Other fish	630	126	540	5	22,700	1,593	24,471	1,754
Crawfish							135,861	3,498
Frogs			982	172	1,750	306	10,732	998
Turtles			67,211	2,324			67,211	2,324
Total	579,067	23,864	58,393,864	1,150,895	2,406,332	100,997	113,727,240	2,611,439

*Includes St. Clair and Detroit rivers. †Includes St. Lawrence and Niagara rivers.

CAVIAR.

Caviar is manufactured to some extent by the fishermen of all the Great Lakes except Lake Superior, where sturgeon are not sufficiently abundant to supply the necessary eggs. This product is also prepared by wholesale fish-dealers, especially in the State of New York on Lake Erie, who either buy the eggs fresh from fishermen or obtain them from sturgeon purchased in a round condition and dressed before being sold. In the early days of the fisheries of this region the value of the sturgeon was apparently unknown to the fishermen, and large quantities of these fish were allowed to go to waste without even being converted into fertilizer; but in 1880 this fishery had reached large proportions and 230,160 pounds of caviar were produced, valued at $34,315.

In 1885 the catch of sturgeon was considerably less than in 1880, but the quantity of caviar had increased to 477,020 pounds, with an approximate value of $57,242, or about 12 cents per pound. The constant decline in the fishery since that time has naturally resulted in a material reduction in the yield of caviar. The greater portion of the output in 1899, including a large percentage of that made by the fishermen, was handled in the wholesale trade of Lake Erie, and amounted to 97,555 pounds, valued at $73,201. The caviar prepared by the fishermen of the various lakes in 1899 amounted to 47,470 pounds, valued at $30,510. About 70 per cent of this was the product of the fisheries of Lake Erie, and nearly 50 per cent, or 20,317 pounds, valued at $12,850, was prepared in Erie County, N. Y. The yield, by States, was as follows: Michigan, 6,569 pounds, $3,435; New York, 31,287 pounds, $20,424; Pennsylvania, 6,274 pounds, $3,992; and Ohio, 3,340 pounds, $2,659.

The quantity and value of caviar prepared by the fishermen of the Great Lakes in 1899 is shown, by lakes, in the following table:

Lakes.	Lbs.	Value.
Michigan	5,044	$2,264
Huron	300	195
St. Clair	960	768
Erie	32,365	21,122
Ontario	*8,801	6,161
Total	47,470	30,510

*Includes for the St. Lawrence River 4,320 pounds, value $2,610, and for the Niagara River 140 pounds, value $70.

COMPARATIVE STATISTICS.

Statistics of the fisheries of the Great Lakes are presented in the following tables for the years 1880, 1885, 1890, 1893, and 1899. The period of greatest development in the fisheries of this region, as indicated by the statistics under comparison, was from 1880 to 1885. In those years the number of persons employed increased from 5,050 to 10,355, the investment from $1,345,975 to $4,520,081, and the products from 68,742,000 pounds, valued at $1,652,900, to 99,842,076 pounds,

valued at $2,691,866. Since then there has been some decrease in the number of persons employed, but a steady increase in the number of pound nets and gill nets, the two most important forms of fishing apparatus used, and also in the total amount of capital invested. The yield of products, except in 1893, has greatly increased in quantity, but has not in any of the years named equaled that of 1885 in value. In 1899 it was slightly exceeded in quantity by that of 1890, but was next in value to that of 1885.

A noteworthy feature of these fisheries is the change that has taken place in the abundance of the different species of fish. In 1880 the white-fish was more abundant than any other species and constituted nearly a third of the products, but in 1899 the catch had decreased to 5,094,014 pounds. In the same period sturgeon decreased from 7,557,383 pounds to 1,129,348 pounds. The yield of trout was larger in 1899 than in 1880, but it has decreased considerably as compared with 1885, 1890, and 1893. Offsetting these decreases, herring has increased from 15,967,517 pounds to 59,913,576 pounds, while the aggregate quantity of several other species, not shown separately in the statistics, increased from 16,948,600 pounds to 36,978,714 pounds. The decline in the abundance of some of the more valuable species is therefore being compensated for by an increase in the cheaper varieties.

Comparative table showing the number of persons employed in the fisheries of the Great Lakes in 1880, 1885, 1890, 1893, and 1899.

Lakes.	1880.	1885.	1890.	1893.	1899.
Superior	414	914	653	916	613
Michigan	1,578	3,379	2,877	3,928	3,255
Huron	470	892	726	944	1,241
St. Clair*	356	272	611	529	442
Erie	1,620	4,298	4,482	3,622	3,728
Ontario	612	600	389	241	391
Total	5,050	10,355	9,738	10,180	9,670

*Includes St. Clair and Detroit rivers.

Comparative table showing the apparatus and capital employed in the fisheries of the Great Lakes in 1880, 1885, 1890, 1893, and 1899.

Lakes and years.	Vessels and boats.		Pound nets and trap nets.		Gill nets.		Seines.		Other apparatus, value.	Shore property and cash capital.	Total investment.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.			
Superior:											
1880	161	$26,240	43	$14,950	4,630	$25,280	32	$2,010	$200	$12,700	$81,380
1885	519	100,735	230	67,520	7,557	78,082	43	2,920	1,155	177,521	427,933
1890	328	85,275	140	34,435	5,974	63,476	19	955	2,763	179,778	366,682
1893	447	139,035	276	63,415	8,899	87,680	14	500	1,565	209,512	529,024
1899	315	69,045	162	25,820	7,229	99,283	1	50	1,058	167,023	372,083
Michigan:											
1880	836	133,375	476	185,425	24,599	124,740	19	2,040	1,455	104,100	551,135
1885	1,402	368,326	715	253,840	58,516	326,902	87	6,950	13,457	788,356	1,757,831
1890	1,102	266,331	844	244,880	40,896	215,914	30	3,480	13,460	693,159	1,437,224
1893	1,549	357,987	785	181,385	54,232	352,084	28	2,520	27,863	1,092,219	2,063,497
1899	1,178	281,968	805	186,349	49,857	288,395	11	510	29,285	2,087,829	2,915,241
Huron:											
1880	111	20,905	189	49,425	3,360	20,600	28	5,600	3,500	3,700	103,730
1885	561	72,946	586	113,350	3,444	35,333	.....	.....	23,100	140,620	385,349
1890	417	36,898	551	88,515	2,206	21,665	6	600	7,155	254,025	408,858
1893	520	87,645	731	108,508	4,923	53,071	1	75	3,807	236,285	503,700
1899	539	87,585	996	111,839	5,676	54,384	9	673	8,188	203,989	474,953

Comparative table showing the apparatus and capital employed in the fisheries of the Great Lakes in 1880, 1885, 1890, 1893, and 1899—Continued.

Lakes and years.	Vessels and boats.		Pound nets and trap nets.		Gill nets.		Seines.		Other apparatus, value.	Shore property and cash capital.	Total investment.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.			
St. Clair:											
1880	52	$8,000	.....	.....	180	$1,080	42	$6,000	$1,500	$24,000	$40,580
1885	215	7,457	57	$12,550	23	160	34	8,825	3,819	218,270	251,081
1890	166	28,775	34	9,450	814	9,418	28	6,240	5,580	150,682	210,145
1893	211	13,728	91	7,400	380	4,260	20	3,025	2,346	206,672	240,076
1899	188	3,770	5	1,050	60	600	13	1,255	915	46,945	54,535
Erie:											
1880	602	83,880	758	233,600	5,775	22,500	18	2,800	8,645	163,675	515,100
1885	1,536	298,757	1,028	259,785	22,641	75,507	71	8,320	72,205	847,564	1,562,138
1890	1,449	520,033	1,893	548,100	49,320	169,513	44	5,305	70,601	1,502,750	2,816,302
1893	1,146	424,227	1,783	439,060	35,369	164,683	47	4,440	23,339	1,423,017	2,506,842
1899	980	435,566	1,724	329,500	41,678	229,182	104	8,390	19,362	1,614,677	2,720,554
Ontario:											
1880	167	13,100	34	14,000	6,000	20,000	9	1,950	.....	5,000	54,050
1885	467	20,448	350	19,445	4,722	23,952	69	3,177	12,627	56,100	135,749
1890	376	31,162	288	24,577	2,345	18,110	27	656	10,361	38,667	123,533
1893	177	9,619	77	2,310	1,185	8,794	7	175	2,240	32,250	56,131
1899	289	9,482	145	5,850	1,187	18,674	24	420	7,194	38,640	80,350
All lakes:											
1880	1,929	285,500	1,500	497,400	44,541	214,200	148	20,400	15,300	313,175	1,345,975
1885	4,700	868,669	2,966	726,490	96,906	539,936	304	30,192	126,363	2,228,431	4,520,081
1890	3,838	968,474	3,750	949,957	101,555	498,096	154	17,236	109,920	2,819,061	5,362,774
1893	4,050	1,032,241	3,743	802,078	104,988	676,572	117	10,735	61,160	3,199,955	5,899,270
1899	3,489	887,416	3,837	660,408	105,687	690,518	162	11,298	66,002	4,159,103	6,617,716

Comparative table showing the products of the fisheries of the Great Lakes in 1880, 1885, 1890, 1893, and 1899.

Lakes and years.	White-fish.	Trout.	Herring.	Sturgeon.	All others.	Total.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Value.
Superior:							
1880	2,257,000	1,464,750	34,000	.....	60,875	3,816,625	$118,370
1885	4,571,947	3,488,177	324,680	182,760	258,416	8,825,980	291,523
1890	3,213,176	2,613,378	199,121	47,482	42,835	6,115,992	220,968
1893	2,732,270	4,342,122	660,272	62,052	300,211	8,096,927	252,107
1899	693,191	3,118,169	1,125,478	4,415	488,401	5,429,654	150,862
Michigan:							
1880	12,030,400	2,659,450	3,050,400	3,839,600	1,562,025	23,141,875	668,400
1885	8,682,986	6,431,298	3,312,493	1,406,678	3,684,693	23,518,148	878,788
1890	5,455,079	8,364,167	6,082,082	946,897	5,586,041	26,434,266	830,465
1893	2,330,060	8,216,926	11,580,895	311,780	8,308,100	30,747,755	828,611
1899	1,510,364	5,488,947	21,573,716	108,279	5,818,690	34,499,996	876,743
Huron:							
1880	2,700,778	2,084,500	246,800	204,000	1,969,195	7,205,273	195,277
1885	1,425,380	2,539,780	1,265,650	215,500	6,010,860	11,457,170	276,397
1890	1,004,094	1,505,619	2,514,551	365,718	4,666,399	10,056,381	221,067
1893	1,178,271	3,439,575	2,758,628	79,553	4,608,311	12,064,338	306,381
1899	592,308	1,887,101	3,699,807	30,497	6,208,614	12,418,327	308,078
St. Clair:							
1880	77,922	.....	250,700	998,500	523,805	1,850,927	36,273
1885	41,125	.....	1,208,150	227,780	708,740	2,185,795	40,193
1890	238,764	244,847	490,334	309,003	1,711,623	2,994,571	73,577
1893	50,950	72,000	140,112	54,106	1,497,143	1,814,311	46,030
1899	69,902	69,915	.....	7,600	431,650	579,067	23,864
Erie:							
1880	3,333,800	26,200	11,774,400	1,970,000	11,982,900	29,087,300	474,880
1885	3,531,855	106,900	19,354,900	4,727,950	23,734,912	51,456,517	1,109,096
1890	2,341,451	121,420	38,868,283	2,078,907	21,440,812	64,850,873	1,000,905
1893	1,292,410	203,132	20,931,076	793,800	19,747,907	42,968,325	805,979
1899	2,066,314	32,024	33,427,797	789,402	22,078,327	58,393,864	1,150,895
Ontario:							
1880	1,061,000	569,700	611,217	545,283	849,800	3,640,000	159,700
1885	90,711	20,510	403,585	386,974	1,496,686	2,398,466	95,869
1890	148,771	41,010	698,978	541,752	2,115,937	3,446,448	124,786
1893	45,380	6,204	164,998	125,293	586,140	928,015	31,510
1899	161,935	15,432	86,778	189,155	1,953,032	2,406,332	100,997
All lakes:							
1880	21,463,900	6,804,600	15,967,517	7,557,383	16,948,600	68,742,000	1,652,900
1885	18,344,004	12,586,665	25,869,458	7,147,642	35,894,307	99,842,076	2,691,866
1890	12,401,335	12,890,441	48,753,349	4,289,759	35,563,647	113,898,531	2,471,768
1893	7,629,341	16,279,953	36,235,981	1,426,584	35,047,812	96,619,671	2,270,618
1899	5,094,014	10,611,588	59,913,576	1,129,348	36,978,714	113,727,240	2,611,439

NOTE.—In the above table caviar and other secondary products are omitted except for 1893 and 1899. In 1880, 1885, and 1890 bluefin, longjaw, and Menominee in Lake Michigan and Menominee in Lake Huron are included with white-fish. In 1893 and 1899 bluefin in Lake Superior, bluefin and Menominee in Lake Michigan, and Menominee in Lake Huron are included with "All others," and longjaw in Lake Michigan with herring.

FISHERIES OF LAKE SUPERIOR.

Although Lake Superior is larger and has a greater depth of water than any of the other Great Lakes, its fisheries are not extensive as compared with those of Lake Erie or Lake Michigan, and even less important than those of Lake Huron. The States bordering this lake are Michigan, Wisconsin, and Minnesota, all of which are more or less interested in the fisheries.

The number of persons employed in the fisheries of Lake Superior in 1899 was 613. There were 72 in the vessel fisheries, 478 in the shore or boat fisheries, and 63 in the wholesale fishery trade and various occupations on shore connected with the fisheries.

The amount of capital invested was $372,083. The number of vessels fishing and transporting fishery products was 10, valued with their outfits at $51,604, and the number of boats used in the shore fisheries was 305, valued at $27,245. The principal forms of fishing apparatus were gill nets, pound nets, and trap nets. The number of gill nets used on vessels was 3,273, worth $42,364, and on boats 3,956, worth $56,919; a total in both branches of the fisheries of 7,229, having a value of $99,283. The number of pound nets and trap nets operated was 162, valued at $25,820. Seines, fyke nets, dip nets, spears, and lines were also employed to a limited extent.

The yield of the fisheries of this lake, including all species, aggregated 5,429,654 pounds, valued at $150,862. The vessel fisheries produced 2,024,022 pounds, valued at $63,459, and the shore fisheries 3,405,632 pounds, valued at $87,403. In the vessel fisheries the catch was taken wholly with gill nets, and in the shore fisheries 2,464,842 pounds, $56,595, were obtained with gill nets, and 768,291 pounds, $25,478, in pound nets and trap nets, and 172,499 pounds, $5,330, with other forms of apparatus. The most important species taken in these fisheries were trout, 3,118,169 pounds, $100,699; white-fish, 693,191 pounds, $25,547; herring, 1,125,478 pounds, $11,770, and bluefin white-fish, 435,060 pounds, $11,317. Wall-eyed pike, pickerel, yellow perch, rock bass, sturgeon, suckers, and bullheads were taken in smaller quantities. The catch of trout in both the vessel and shore fisheries was larger than that of any other species. The quantity taken by vessels was 1,563,799 pounds, valued at $49,887, and by boats in the shore fisheries 1,554,370 pounds, valued at $50,812.

A comparison of the statistics for 1899 with those for 1893 shows a decrease of 303 in the number of persons employed, $156,941 in the amount of capital invested, and 2,667,273 pounds in the quantity and $101,245 in the value of the products. A scarcity of fish is reported from all the best fishing-grounds, and is most noticeable in those parts

of the lake heretofore depended upon for an unfailing supply. Whitefish Bay, at the eastern end of Lake Superior, has always been noted for the large quantities of white-fish and trout taken in its waters, but the catch is becoming smaller each succeeding year. At Whitefish Point, in this bay, in the year 1893 five steamers, fishing 1,360 gill nets, and 52 pound nets operated by small boats, took 833,068 pounds of white-fish and 1,074,541 pounds of trout. In 1899 there was but one vessel, with 360 gill nets, and the number of pound nets had been reduced to 16; the catch was only 204,718 pounds of white-fish and 260,689 pounds of trout; a decrease between the years mentioned of 628,350 pounds of white-fish and 813,852 pounds of trout. Other localities on the lake show a falling off in products, although to a smaller extent usually than the one cited, but there are very few instances in which any increase has occurred.

Protective legislation.—An effort has been made by the States having a frontage on Lake Superior to arrest the decline in the fisheries. The State of Michigan has followed Wisconsin by enacting a close season on the Great Lakes. The law of Michigan provides for a cessation of fishing from October 30 to December 15 in each year, and that of Wisconsin from November 1 to December 15. These laws, it is claimed, will afford greater protection to the fish during the spawning period. Furthermore, Wisconsin has a law prohibiting the fishing of pound nets from the mainland in Chequamegon or Ashland bay, and no gill nets are allowed to be fished within 1 mile of the shore. These laws do not apply to the islands in the body of water mentioned, which are also owned by the State of Wisconsin.

The principal fishes.—The fisheries of Lake Superior depend largely upon the catch of trout and white-fish, and when a scarcity in these species occurs the season is considered a poor one by the fishermen. The white-fish has always been the more important species, and has constituted the greater part of the products, but in 1893 the catch of this fish had fallen off considerably and was exceeded by that of trout. Since that time the trout has been as prominent as the white-fish formerly was, and the catch of trout in 1899 represented over half the entire yield of the lake. In the meantime the catch of white-fish has decreased from 2,732,270 pounds, valued at $93,672 in 1893, to 693,191 pounds, valued at $25,547 in 1899. White-fish and trout do not run together to any great extent until a few weeks before and during the spawning season. At other times of the year they are found separate, and the catch from different grounds is either all white-fish or all trout, as the case may be. The fishermen have also noticed that the fishing-grounds from which a large catch of these species has been taken in the fall yield a much smaller quantity of fish when visited again the following spring.

The herring is abundant in all parts of the lake. It is caught prin-

cipally in gill nets, although small quantities are also caught in pound nets and with other forms of apparatus. Within the past few years there has been a greater demand for this species than formerly, and consequently a large increase in the quantity taken. The catch in 1899 was nearly twice as large as in any previous year for which statistics are available. It is probable that the abundance of other more valuable species has heretofore had a tendency to deter the fishermen from the capture of herring.

The pike perches are not abundant in this lake, and the annual catch has never exceeded a few thousand pounds. The wall-eyed pike, which is the principal member of this group of fishes in Lake Superior, was caught chiefly in pound nets in Chippewa and Ontonagon counties, Michigan. A small quantity was also caught in Wisconsin, but none in Minnesota.

The sturgeon has never been found in large quantities in this lake, and is apparently becoming less plentiful every year. The catch in 1899 was nearly all taken in pound nets in Chippewa, Houghton, and Ontonagon counties, Michigan, and amounted to only 4,415 pounds, valued at $176.

In the section of the St. Marys River between Sault Ste. Marie and Sailors Encampment, the fisheries of which are included in the present statistics with those of Lake Superior, a number of species are taken in small quantities which do not occur in the lake proper. The more important of these are pickerel or grass pike, yellow perch, bullheads, and rock bass. The apparatus in which they are caught consists of trap nets, gill nets, and fyke nets. During the winter the gill nets are fished under the ice. The catch from this part of the river is marketed at Sault Ste. Marie.

Bluefin white-fish.—The bluefin white-fish (*Argyrosomus nigripinnis*) has within recent years become important in the fisheries of Lake Superior. It was first noticed in Whitefish Bay in 1893, and a catch of 36,818 pounds, valued at $1,326, was secured. Since that time it has increased in abundance and has become quite generally distributed, but the catch is greater in the southern and western than in the northern and eastern parts of the lake. It was formerly regarded with little favor by the fishermen, but now that the white-fish is becoming scarce the bluefin is caught in larger quantities. It finds a ready market, and being a prolific species may in some measure compensate for the falling off in the catch of white-fish.

The bluefin is said by Mr. John Hawley, of Ontonagon, to have made its first appearance in the western part of the lake in the spring of 1894. In 1897 Mr. Hawley's catch with one steamer equipped with gill nets was 230,000 pounds, and in 1899 it was 200,200 pounds, while the quantity of white-fish taken by this steamer in the last-named year was only 13,900 pounds. In some parts of the lake the bluefin occurs only in deep water, but in others it is frequently caught in June in

30 to 35 fathoms. In August, which is considered the best month for catching this species, it is usually found in depths varying from 65 to 70 fathoms.

Steelhead and rainbow trout.—The steelhead trout (*Salmo gairdneri*) and the rainbow trout (*Salmo irideus*), two species from the Pacific coast, which were planted in streams entering Lake Superior, have begun to make their appearance in the open waters of the lake and are taken in the nets of the fishermen. They were formerly confined to the streams where the original plants of fry were made. Regarding the capture of steelhead trout, the report of this Commission for the year 1899 contains the following statement:

> Particularly gratifying reports have been received from Minnesota with reference to the introduction of steelhead trout in Lake Superior. Mr. L. E. Baldridge, foreman of Duluth station, Minnesota, reports, under date of March 13, 1899, that large numbers of steelhead trout, varying in length from 7 to 28 inches, were caught during the summer and fall of 1898 along the north shore of Lake Superior, between Duluth, Minn., and Rossport, Ontario. Mr. D. J. Greensword, treasurer of the Duluth Fly-Casting Club, informed him that a number of members of his club took over 400 steelhead trout from Sucker River in two days' fishing with hook and line, and that he had captured 85 in a single day. He further states that not less than 2,200 steelheads were taken in the same manner from the French and Sucker rivers, and that they take the fly as readily as do the brook trout. The fishermen operating gill nets along the north shore for lake trout have also captured a number, varying from 14 to 18 inches in length. It appears that the steelheads caught in nets had slipped through the nets until the twine was just forward of the dorsal fin, which would indicate that they were too small to be taken in very large numbers in the large-mesh nets used for the capture of lake trout. The steelheads are probably as plentiful in other rivers along the north shore, which are not visited on account of their remoteness from Duluth.

The fish above alluded to, it will be noticed, were all taken in localities at the western end of the lake, but during a statistical investigation of the fisheries of Lake Superior in 1900 it was learned that the fishermen at the eastern end of the lake had secured a number of fish which they reported as rainbow trout. In the summer of 1899 three of these fish were caught at Whitefish Point. It was also reported at Marquette that specimens had been taken off Grand Island and in Huron Bay. On July 9, 1900, a fine specimen, weighing 7 pounds and measuring 27 inches in length, was caught in a net at Whitefish Point by the A. Booth Company. On July 10 of the same year another one, weighing 6½ pounds and measuring 23 inches in length, was caught in an inshore pound net off Lizard Island, Canada, in about 40 feet of water. In the same month two other specimens, weighing about 4 pounds each, were taken in nets at Indian Harbor, Canada.

Apparatus and methods.—Gill nets are used in every county on the lake, and pound nets in all of the counties except Gogebic and Marquette counties in Michigan, Iron County in Wisconsin, and Lake and St. Louis counties in Minnesota. As compared with the statistics for 1893 there has been a decrease of 1,670 gill nets and 151 pound nets.

Trap nets, fyke nets, dip nets, and spears occur in the fisheries of this lake only in the St. Mary River, in Chippewa County. Trap nets were not operated in 1893, but in 1899 the number employed was 37, valued at $960.

In the vessel fisheries gill nets are used for catching white-fish and trout, and since the bluefin white-fish has become abundant in the lake many of the steamers are also equipped with a separate rig of gill nets for the capture of that species. The principal difference in the various kinds of nets is in the size of the mesh. The size of the mesh in white-fish and trout nets is ordinarily 4¼ to 4½ inches, and in bluefin nets it is about 3¾ inches, stretched measure. The gill nets at White-fish Point and Grand Marais are 810 feet in length and are termed "90-lead nets" by the fishermen, for the reason that each net is rigged with 90 leads placed 9 feet apart. The nets in use on steamers fishing from Marquette average 650 feet in length with a mesh of 4¼ inches, but in the fall of the year nets having a mesh of 5½ inches are used for taking large trout which visit the spawning-grounds in September and October. At Bayfield the length of gill nets used on vessels is about 675 feet each, and at Ontonagon it is about 800 feet. At Houghton a steamer fishes 290 nets of 1,800 feet in length each, or a total length of 522,000 feet. The custom there is to join two nets together, each of which has 100 leads and is 900 feet long.

The nets are always set at the bottom of the lake, and frequently in depths of 700 feet, 35 to 45 pounds of lead being used on a net 650 to 800 feet long. The only satisfactory floats so far used are made of cedar. Glass floats have been tried, but the great pressure at the depth in which these nets are fished caused the water to penetrate the glass, and when the floats were brought to the surface the water still remained in them. An experiment was also made with tin floats, but they were too easily crushed out of their proper shape. To overcome this difficulty they were strongly braced, but were then found to admit water.

The gill nets employed by boats in the shore fisheries are similar to those used on vessels, except that on the average they are not quite so long. The white-fish and trout nets are generally from 425 to 720 feet in length, but along the north shore and around Isle Royal they are about 1,200 feet long. The size of mesh varies from 4½ to 7 inches, the large-meshed nets being used for trout in shallow water in the autumn. Herring nets are from 250 to 300 feet long, and the size of the mesh is about 3½ inches.

In fishing gill nets with steamers the practice is to set them in gangs of 45 nets or more. About half the nets in each gang are lifted each day and carried home to be dried and repaired. These are replaced with a similar quantity of dry nets.

The steamers are nearly all equipped with a patent net lifter which

enables the crews to handle a larger number of nets than could be operated by hand. Nets are lifted with this device by being carried over a drum or cylinder worked by steam. While the nets are being lifted a careful watch is kept for the fish, and when they are seen to approach within 2 or 3 feet of the surface of the water the larger ones are helped over the side of the vessel with a gaff hook, otherwise the fish might be lost or the nets damaged by their weight. The gaff hook used has a handle about 7 feet in length.

Preservation of gill nets.—The fishermen of Lake Superior, in order to preserve their gill nets, tan them with hemlock bark or the extract of hemlock, generally the latter. A pint of extract is sufficient for tanning 25 nets, and 5 gallons will last an entire season for a rig of 350 nets, 1 pint of extract being used to 50 gallons of water. The mixture is boiled in a large kettle, after which the nets are placed in it and allowed to remain an hour. The nets require this treatment about once in every two months, and in warm weather it is necessary to tan them more frequently.

Introduction of naphtha engines.—An innovation in shore fisheries is the introduction of naphtha engines as an auxiliary means of propelling sailboats. They are said to have been introduced by Messrs. Peter Anderson & Sons, a fishing firm at Marquette, who fitted a sailboat in this manner in 1899. The engine used was of 12 horsepower, and the boat has a speed of 7½ miles an hour. This boat can make much longer fishing trips than when it was propelled exclusively by sails, and the number of nets fished has been more than doubled. It is probable that the use of naphtha engines will in a few years become quite general in these fisheries. A number of boats were equipped with them in 1900.

Fishing season.—The gill-net fishing begins as soon as the ice breaks up in the spring, which is generally sometime in April. The nets are then fished in 20 to 40 fathoms of water, and the catch consists chiefly of trout. The white-fish run comes later in the season, the greater part of the catch being taken in July and August. This is also the time of year in which the bluefin white-fish are taken in greatest abundance. The fishing for trout continues all through the summer and fall. In midsummer the nets are fished in 70 to 100 fathoms of water, but in the fall they are again set in shallow water. About September 1 the large trout come into shallow water to spawn and are caught there in considerable quantities during the months of September and October. Pound nets are set as soon as practicable after the ice breaks up in the spring and are fished until about the first of November.

Statistics.—The extent of the fisheries of Lake Superior in 1899 is shown by States and counties in the following series of five tables:

Table showing, by States and counties, the number of persons employed in the fisheries of Lake Superior in 1899.

States and counties.	On vessels fishing.	On vessels transporting.	In shore fisheries.	On shore, in fish houses, etc.	Total.
Michigan:					
Alger	16		28	3	47
Baraga			15		15
Chippewa	8		35	14	57
Gogebic			2		2
Houghton	7		24	3	34
Keweenaw			78		78
Marquette	13		13	9	35
Ontonagon	7		15	4	26
Total	51		210	33	294
Minnesota:					
Cook			61		61
Lake			41		41
St. Louis			25	24	49
Total			127	24	151
Wisconsin:					
Ashland			111		111
Bayfield	16	5	28	6	55
Iron			2		2
Total	16	5	141	6	168
Grand total	67	5	478	63	613

Table showing, by States and counties, the apparatus and capital employed in the fisheries of Lake Superior in 1899.

States and counties.	Vessels fishing.				Vessels transporting.				Boats.		Apparatus of capture—vessel fisheries.	
	No.	Tonnage.	Value.	Value of outfit.	No.	Tonnage.	Value.	Value of outfit.	No.	Value.	Gill nets.	
											No.	Value.
Michigan:												
Alger	2	69	$11,500	$1,200	....	.....	.....	.....	22	$1,850	720	$9,360
Baraga	....	.....	.....	.....	....	.....	.....	.....	11	710	.....	.....
Chippewa	1	58	4,000	600	....	.....	.....	.....	17	1,195	360	4,680
Gogebic	....	.....	.....	.....	....	.....	.....	.....	1	100	.....	.....
Houghton	1	26	6,000	700	....	.....	.....	.....	11	550	290	7,250
Keweenaw	....	.....	.....	.....	....	.....	.....	.....	60	5,440	.....	.....
Marquette	2	22	8,300	2,150	....	.....	.....	.....	9	1,570	690	8,944
Ontonagon	1	25	3,000	1,200	....	.....	.....	.....	7	665	413	4,130
Total	7	200	32,800	5,850	....	.....	.....	.....	138	12,080	2,473	34,364
Wisconsin:												
Ashland	....	.....	.....	.....	....	.....	.....	.....	60	5,000	.....	.....
Bayfield	2	59	6,000	2,654	1	18	$3,000	$1,300	15	2,135	800	8,000
Iron	....	.....	.....	.....	....	.....	.....	.....	1	100	.....	.....
Total	2	59	6,000	2,654	1	18	3,000	1,300	76	7,235	800	8,000
Minnesota:												
Cook	....	.....	.....	.....	....	.....	.....	.....	54	5,085	.....	.....
Lake	....	.....	.....	.....	....	.....	.....	.....	24	1,970	.....	.....
St. Louis	....	.....	.....	.....	....	.....	.....	.....	13	875	.....	.....
Total	....	.....	.....	.....	....	.....	.....	.....	91	7,930	.....	.....
Grand total	9	259	38,800	8,504	1	18	3,000	1,300	305	27,245	3,273	42,364

Table showing, by States and counties, the apparatus and capital employed in the fisheries of Lake Superior in 1899—Continued.

States and counties.	Apparatus of capture—shore fisheries.												
	Pound nets and trap nets.		Gill nets.		Fyke nets.		Dip nets.		Spears.		Haul seines.		Set lines and hand lines.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	
Michigan:													
Alger	18	$2,525	240	$2,312	....	.....	....	.....	....	.....	....	.....	.....
Baraga	12	2,250	97	824	....	.....	....	.....	....	.....	....	.....	.....
Chippewa	53	6,735	19	152	15	$150	30	$300	20	$20	....	.....	.....
Gogebic	.....	.....	40	400	....	.....	....	.....	....	.....	....	.....	.....
Houghton	7	1,575	552	4,326	....	.....	....	.....	....	.....	....	.....	.....
Keweenaw	20	3,375	726	18,765	....	.....	....	.....	....	.....	....	.....	$107
Marquette	.....	.....	515	6,081	....	.....	....	.....	....	.....	1	$50	.....
Ontonagon	14	2,035	71	550	....	.....	....	.....	....	.....	....	.....	.....
Total	124	18,495	2,260	33,410	15	150	30	300	20	20	1	50	107
Wisconsin:													
Ashland	16	2,500	691	6,465	....	.....	....	.....	....	.....	....	.....	314
Bayfield	16	3,825	220	2,280	....	.....	....	.....	....	.....	....	.....	12
Iron	.....	.....	10	90	....	.....	....	.....	....	.....	....	.....	.....
Total	32	6,325	921	8,835	....	.....	....	.....	....	.....	....	.....	326
Minnesota:													
Cook	6	1,000	392	9,472	....	.....	....	.....	....	.....	....	.....	130
Lake	.....	.....	292	4,407	....	.....	....	.....	....	.....	....	.....	25
St. Louis	.....	.....	91	795	....	.....	....	.....	....	.....	....	.....	.....
Total	6	1,000	775	14,674	....	.....	....	.....	....	.....	....	.....	155
Grand total	162	25,820	3,956	56,919	15	150	30	300	20	20	1	50	588

States and counties.	Shore property and accessories.	Cash capital.	Total investment.	States and counties.	Shore property and accessories.	Cash capital.	Total investment.
Michigan:				Wisconsin:			
Alger	$5,700	.....	$34,447	Ashland	$3,800	.....	$18,079
Baraga	560	.....	4,344	Bayfield	10,425	$7,000	46,631
Chippewa	39,175	$20,000	77,007	Iron	40	.....	230
Gogebic	40	.....	540	Total	14,265	7,000	64,940
Houghton	4,770	4,000	29,171	Minnesota:			
Keweenaw	2,675	.....	30,362	Cook	2,770	.....	18,457
Marquette	5,255	10,000	42,350	Lake	1,150	.....	7,552
Ontonagon	1,335	.....	12,915	St. Louis	33,328	15,000	49,998
Total	59,510	34,000	231,136	Total	37,248	15,000	76,007
				Grand total	111,023	56,000	372,083

Table showing, by States, counties, and species, the yield of the fisheries of Lake Superior in 1899.

States and counties.	Cat-fish and bullheads.		Herring, fresh.		Herring, salted.		Yellow perch.		Pike and pickerel.		Rock bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Michigan:												
Alger	.....	.....	.....	.....	460	$9	.....	.....	.....	.....	.....	.....
Baraga	.....	.....	1,500	$30	.....	.....	.....	.....	.....	.....	.....	.....
Chippewa	7,600	$304	8,000	120	100	2	3,879	$39	15,602	$316	931	$28
Houghton	.....	.....	50,900	1,018	5,000	175	.....	.....	.....	.....	.....	.....
Keweenaw	.....	.....	7,811	117	17,140	343	.....	.....	.....	.....	.....	.....
Total	7,600	304	68,211	1,285	22,700	529	3,879	39	15,602	316	934	28
Minnesota:												
Cook	.....	.....	9,973	150	102,670	2,053	.....	.....	.....	.....	.....	.....
Lake	.....	.....	74,935	1,128	109,240	2,185	.....	.....	.....	.....	.....	.....
St. Louis	.....	.....	40,790	816	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	125,698	2,094	211,910	4,238	.....	.....	.....	.....	.....	.....
Wisconsin:												
Ashland	.....	.....	669,324	3,347	1,200	12	.....	.....	.....	.....	.....	.....
Bayfield	.....	.....	22,785	228	3,650	37	.....	.....	.....	.....	.....	.....
Total	.....	.....	692,109	3,575	4,850	49	.....	.....	.....	.....	.....	.....
Grand total	7,600	304	886,018	6,954	239,460	4,816	3,879	39	15,602	316	934	28

Table showing, by States, counties, and species, the yield of the fisheries of Lake Superior in 1899—Continued.

States and counties.	Sturgeon.		Suckers, fresh.		Suckers, salted.		Trout, fresh.		Trout, salted.		Pike perch (wall eyed).	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Michigan:												
Alger					5,200	$104	444,353	$13,360	47,200	$1,888		
Baraga							33,955	1,408				
Chippewa	711	$34	3,000	$15			256,067	7,408	36,605	1,414	8,338	$251
Gogebic							10,583	366				
Houghton	600	25					205,470	7,817	17,000	765		
Keweenaw							203,329	6,661	158,148	4,902		
Marquette			2,200	40			531,059	17,948	33,800	1,415		
Ontonagon	3,074	116					183,893	6,369			4,131	207
Total	4,385	175	5,200	55	5,200	104	1,868,709	61,337	292,753	10,384	12,469	458
Minnesota:												
Cook							121,828	3,524	52,962	1,516		
Lake							35,352	1,023	19,645	589		
St. Louis							13,098	461	4,410	132		
Total							170,278	5,008	77,017	2,237		
Wisconsin:												
Ashland	30	1					262,677	8,058	22,290	669	1,210	37
Bayfield			247	2	1,000	10	362,624	11,149	60,031	1,800		
Iron							550	20	1,240	37		
Total	30	1	247	2	1,000	10	625,851	19,227	83,561	2,506	1,210	37
Grand total	4,415	176	5,447	57	6,200	114	2,664,838	85,572	453,331	15,127	13,679	495

States and counties.	White-fish, fresh.		White-fish, salted.		White-fish (blue-fin), fresh.		White-fish (bluefin), salted.		White-fish (blue-fin), smoked.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Michigan:										
Alger	109,037	$3,679	400	$16	71,431	$1,273	1,600	$32		
Baraga	20,551	979								
Chippewa	204,718	6,143	20,000	800	6,004	109				
Gogebic	622	26								
Houghton	111,768	4,708	3,000	135	50,976	1,622				
Keweenaw	51,455	2,074	8,400	336	75,156	2,077	175	4		
Marquette	51,737	2,237			2,882	79				
Ontonagon	36,869	1,569			200,200	5,460				
Total	586,757	21,115	31,800	1,287	406,649	10,620	1,775	36		
Minnesota:										
Cook	6,422	239	6,455	258	2,594	48	3,550	89		
Lake					1,468	27	2,245	56	320	$16
St. Louis			195	8	787	14				
Total	6,422	239	6,650	266	4,849	89	5,795	145	320	16
Wisconsin:										
Ashland	32,453	1,203	5,589	224	1,490	33	455	9		
Bayfield	21,818	844	1,462	59	11,525	300	1,685	43	517	26
Iron	220	9	20	1						
Total	54,491	2,056	7,071	284	13,015	333	2,140	52	517	26
Grand total	647,670	23,710	45,521	1,837	424,513	11,042	9,710	233	837	42

Summary of the yield of the fisheries of Lake Superior in 1899.

States and counties.	Lbs.	Value.	States and counties.	Lbs.	Value.
Michigan:			Minnesota:		
Alger	679,681	$20,361	Cook	306,454	$7,877
Baraga	56,006	2,417	Lake	243,205	5,024
Chippewa	571,558	16,983	St. Louis	59,280	1,431
Gogebic	11,205	392	Total	608,939	14,332
Houghton	444,714	16,265	Wisconsin:		
Keweenaw	521,614	16,514	Ashland	996,718	13,593
Marquette	621,678	21,719	Bayfield	487,344	14,498
Ontonagon	428,167	13,721	Iron	2,050	67
Total	3,334,623	108,372	Total	1,486,092	28,158
			Grand total	5,429,654	150,862

Table showing, by States, counties, and species, the yield of vessel gill-net fisheries of Lake Superior in 1899.

States and counties.	White-fish, fresh.		White-fish, salted.		White-fish (blue-fin), fresh.		White-fish (blue-fin), salted.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Michigan:								
Alger	16,147	$467			68,226	$1,241	1,600	$32
Chippewa	19,335	559			6,004	109		
Houghton	28,036	1,159			50,976	1,622		
Marquette	31,487	1,525			2,882	79		
Ontonagon	13,915	690			200,200	5,460		
Total	111,920	4,400			328,288	8,511	1,600	32
Wisconsin:								
Bayfield	8,264	340	270	$11	8,981	246	695	21
Grand total	120,184	4,740	270	11	337,269	8,757	2,295	53

States and counties.	Trout, fresh.		Trout, salted.		Pike perch (wall-eyed).		Sturgeon.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Michigan:										
Alger	348,811	$10,090	47,200	$1,888					481,984	$13,718
Chippewa	197,409	5,710	31,605	1,264					254,353	7,642
Houghton	84,112	3,128	12,000	540					175,124	6,449
Marquette	369,791	12,168	12,500	563					419,660	14,335
Ontonagon	123,420	4,080			131	$7	74	$4	337,740	10,241
Total	1,123,543	35,176	103,305	4,255	131	7	74	4	1,668,861	52,385
Wisconsin:										
Bayfield	280,471	8,763	56,480	1,693					355,161	11,074
Grand total	1,404,014	43,939	159,785	5,948	131	7	74	4	2,024,022	63,459

Table showing, by States, counties, species, and apparatus of capture, the yield of the shore fisheries of Lake Superior in 1899.

Apparatus and species.	Michigan.							
	Alger.		Baraga.		Chippewa.		Gogebic.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets and trap nets:								
Cat-fish and bullheads					6,200	$248		
Herring, salted	460	$9			100	2		
Pike and pickerel					8,358	109		
Pike perch (wall-eyed)					6,698	202		
Rock bass					734	22		
Sturgeon					711	34		
Suckers, salted	5,200	104						
Trout, fresh	35,126	1,272	21,195	$815	31,675	917		
White-fish, fresh	57,988	2,069	12,685	575	165,383	4,784		
White-fish, salted	400	16			20,000	800		
Yellow perch					3,035	30		
Total	99,174	3,470	33,880	1,390	242,894	7,148		
Gill nets:								
Herring, fresh			1,500	30				
Pike and pickerel					5,125	154		
Trout, fresh	60,416	1,998	12,760	593			10,583	$366
White-fish, fresh	34,902	1,143	7,866	404			622	26
White-fish (bluefin), fresh	3,205	32						
Total	98,523	3,173	22,126	1,027	5,125	154	11,205	392
Fyke nets:								
Cat-fish and bullheads					1,400	56		
Pike and pickerel					2,119	53		
Pike perch (wall-eyed)					1,649	49		
Rock bass					209	6		
Yellow perch					844	9		
Total					6,203	173		

Table showing, by States, counties, species, and apparatus of capture, the yield of the shore fisheries of Lake Superior in 1899—Continued.

Apparatus and species.	Michigan—continued.							
	Alger.		Baraga.		Chippewa.		Gogebic.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Dip nets and spears:								
Herring					8,000	$120		
Suckers					3,000	15		
White-fish					20,000	800		
Total					31,000	935		
Lines:								
Trout, fresh					26,983	781		
Trout, salted					5,000	150		
Total					31,983	931		
Grand total	197,697	$6,643	56,006	$2,417	317,205	9,341	11,205	$392

Apparatus and species.	Michigan—continued.									
	Houghton.		Keweenaw.		Marquette.		Ontonagon.		Total.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Pound nets and trap nets:										
Cat-fish and bullheads									6,200	$248
Herring, salted									560	11
Pike and pickerel									8,358	109
Pike perch (wall-eyed)							4,000	$200	10,698	402
Rock bass									734	22
Sturgeon	600	$25					3,000	112	4,311	171
Suckers, salted									5,200	104
Trout, fresh	34,423	1,330	82,134	$3,045			30,420	1,169	234,973	8,548
Trout, salted			1,900	80					1,900	80
White-fish, fresh	27,637	1,256	33,024	1,340			22,954	879	319,671	10,903
White-fish, salted									20,400	816
White-fish (bluefin)			49,044	1,561					49,044	1,561
Yellow perch									3,035	30
Total	62,660	2,611	166,102	6,026			60,374	2,360	665,084	23,005
Gill nets:										
Herring, fresh	50,900	1,018	7,811	117					60,211	1,165
Herring, salted	5,000	175	17,140	343					22,140	518
Pike and pickerel									5,125	154
Suckers					2,200	$40			2,200	40
Trout, fresh	86,935	3,359	121,195	3,616	161,268	5,780	30,053	1,120	483,210	16,832
Trout, salted	5,000	225	156,248	4,822	21,300	852			182,548	5,899
White-fish, fresh	56,095	2,293	18,431	734	14,610	602			132,526	5,202
White-fish, salted	3,000	135	8,400	336					11,400	471
White-fish (bluefin), fresh			26,112	516					29,317	548
White-fish (bluefin), salted			175	4					175	4
Total	206,930	7,205	355,512	10,488	199,378	7,274	30,053	1,120	928,852	30,833
Fyke nets:										
Cat-fish and bullheads									1,400	56
Pike and pickerel									2,119	53
Pike perch (wall-eyed)									1,640	49
Rock bass									200	6
Yellow perch									844	9
Total									6,203	173
Seines:										
White-fish					2,640	110			2,640	110
Dip nets and spears:										
Herring									8,000	120
Suckers									3,000	15
White-fish									20,000	800
Total									31,000	935
Lines:										
Trout, fresh									26,983	781
Trout, salted									5,000	150
Total									31,983	931
Grand total	269,590	9,816	521,614	16,514	202,018	7,384	90,427	3,480	1,665,762	55,987

Table showing, by States, counties, species, and apparatus of capture, the yield of the shore fisheries of Lake Superior in 1899.

Apparatus and species.	Minnesota.							
	Cook.		Lake.		St. Louis.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets and trap nets:								
Herring, salted	100	$2					100	$2
Trout	12,100	350					12,100	350
White-fish, fresh	2,130	79					2,130	79
White-fish, salted	325	13					325	13
White-fish (bluefin)	587	11					587	11
Total	15,242	455					15,242	455
Gill nets:								
Herring, fresh	9,973	150	74,935	$1,128	40,790	$816	125,698	2,094
Herring, salted	102,570	2,051	109,240	2,185			211,810	4,236
Trout, fresh	82,695	2,392	24,341	704	13,098	461	120,134	3,557
Trout, salted	51,667	1,477	19,645	589	4,410	132	75,722	2,198
White-fish, fresh	4,292	160					4,292	160
White-fish, salted	6,130	245			195	8	6,325	253
White-fish (bluefin), fresh	2,007	37	1,468	27	787	14	4,262	78
White-fish (bluefin), salted	3,550	89	2,245	56			5,795	145
White-fish (bluefin), smoked			320	16			320	16
Total	262,884	6,601	232,194	4,705	59,280	1,431	554,358	12,737
Lines:								
Trout, fresh	27,033	782	11,011	319			38,044	1,101
Trout, salted	1,295	39					1,295	39
Total	28,328	821	11,011	319			39,339	1,140
Grand total	306,454	7,877	243,205	5,024	59,280	1,431	608,939	14,332

Apparatus and species.	Wisconsin.							
	Ashland.		Bayfield.		Iron.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.
Pound nets and trap nets:								
Herring, fresh	24,095	$121	2,410	$24			26,505	$145
Herring, salted			1,950	20			1,950	20
Suckers, fresh			247	2			247	2
Suckers, salted			900	9			900	9
Trout, fresh	8,948	259	29,231	846			38,179	1,105
Trout, salted	435	13	590	18			1,025	31
Pike perch (wall-eyed)	1,153	35					1,153	35
White-fish, fresh	6,305	235	11,514	428			17,819	663
White-fish, salted			187	8			187	8
Total	40,936	663	47,029	1,355			87,965	2,018
Gill nets:								
Herring, fresh	645,229	3,226	20,375	204			665,604	3,430
Herring, salted	1,200	12	1,700	17			2,900	29
Sturgeon	30	1					30	1
Suckers, salted			100	1			100	1
Trout, fresh	199,441	5,975	49,671	1,437	550	$20	249,662	7,432
Trout, salted	18,060	542	2,961	89	1,240	37	22,261	668
Pike perch (wall-eyed)	57	2					57	2
White-fish, fresh	26,148	968	2,040	76	220	9	28,408	1,053
White-fish, salted	5,589	224	1,005	40	20	1	6,614	265
White-fish (bluefin), fresh	1,490	33	2,544	54			4,034	87
White-fish (bluefin), salted	455	9	990	22			1,445	31
White-fish (bluefin), smoked			517	26			517	26
Total	897,699	10,992	81,903	1,966	2,030	67	981,632	13,025
Lines:								
Trout, fresh	54,288	1,824	3,251	103			57,539	1,927
Trout, salted	3,795	114					3,795	114
Total	58,083	1,938	3,251	103			61,334	2,041
Grand total	996,718	13,593	132,183	3,424	2,030	67	1,130,931	17,084

Summary of the yield of the shore fisheries of Lake Superior in 1899.

Apparatus and species.	Lbs.	Value.
Pound nets and trap nets:		
Cat-fish and bullheads	6,200	$248
Herring, fresh	26,505	145
Herring, salted	2,610	33
Pike and pickerel	8,358	109
Pike perch (wall-eyed)	11,851	437
Rock bass	734	22
Sturgeon	4,311	171
Suckers, fresh	247	2
Suckers, salted	6,100	113
Trout, fresh	285,252	10,003
Trout, salted	2,925	111
White-fish, fresh	339,620	11,645
White-fish, salted	20,912	837
White-fish (bluefin)	49,631	1,572
Yellow perch	3,035	30
Total	768,291	25,478
Fyke nets:		
Bullheads	1,400	56
Pike and pickerel	2,119	53
Pike perch (wall-eyed)	1,640	49
Rock bass	200	6
Yellow perch	844	9
Total	6,203	173
Seines:		
White-fish	2,640	110
Gill nets:		
Herring, fresh	851,513	$6,689
Herring, salted	236,850	4,783
Pike and pickerel	5,125	154
Pike perch (wall-eyed)	57	2
Sturgeon	30	1
Suckers, fresh	2,200	40
Suckers, salted	100	1
Trout, fresh	853,006	27,821
Trout, salted	280,531	8,765
White-fish, fresh	165,226	6,415
White-fish, salted	24,339	989
White-fish (bluefin), fresh	37,613	713
White-fish (bluefin), salted	7,415	180
White-fish (bluefin), smoked	837	42
Total	2,464,842	56,595
Dip nets and spears:		
Herring	8,000	120
Suckers	3,000	15
White-fish	20,000	800
Total	31,000	935
Lines:		
Trout, fresh	122,566	3,809
Trout, salted	10,090	303
Total	132,656	4,112
Grand total	3,405,632	87,403

WHOLESALE FISHERY TRADE.

The wholesale fishery trade of Lake Superior was carried on by six establishments, located as follows: One at Sault Ste. Marie, two at Marquette, one at Houghton, one at Bayfield, and one at Duluth. The number of persons employed in the trade was 50; the investment in shore property was $56,853; the cash capital utilized was $56,000; the amount of wages paid during the year was $29,425, and the products handled aggregated 5,818,183 pounds, the selling value of which was $237,231.

The following table shows the products handled in the wholesale trade of Lake Superior in 1899:

Table showing products handled in the wholesale fishery trade of Lake Superior in 1899.

Products handled.	Lbs.	Value.
Cat-fish and bullheads	5,863	$205
Herring, fresh	36,219	724
Herring, salted	209,390	5,211
Herring, frozen	827,109	16,542
Pike and pickerel	17,253	245
Pike perch (wall-eyed)	10,753	395
Rock bass	804	12
Sturgeon	3,311	133
Suckers, fresh	225	2
Suckers, salted	1,000	10
Trout, fresh	3,035,797	138,762
Trout, frozen	100,000	6,000
Trout, salted	666,702	$29,221
White-fish, fresh	645,141	31,263
White-fish, salted	26,931	1,316
White-fish (bluefin), fresh	224,907	7,040
White-fish (bluefin), salted	2,345	68
White-fish (bluefin), smoked	320	20
Yellow perch	4,113	62
Total	5,818,183	237,231

FISHERIES OF LAKE MICHIGAN.

The persons engaged in the fisheries of Lake Michigan in 1899 numbered 3,255, of whom 463 were employed on vessels, 2,045 in the shore fisheries, and 747 were shoresmen. 1,330 are credited to the State of Michigan, 1,184 to Wisconsin, 685 to Illinois, and 56 to Indiana.

The total investment in the fisheries of this lake was $2,915,241. The number of vessels fishing and transporting was 80, valued with their outfits at $254,905. The number of boats was 1,098, worth $67,968. The apparatus in the vessel fisheries was valued at $205,382, and in the shore fisheries at $299,157. Shore and accessory property was valued at $869,629 and cash capital at $1,218,200. The greater part of the investment, $1,871,341, is credited to Illinois, $554,399 to Wisconsin; $456,287 to Michigan, and $33,214 to Indiana.

The fishery products of this lake amounted to 34,499,996 pounds, valued at $876,743. The largest item is that of herring, of which 21,573,716 pounds were taken, worth $434,029. The trout fishery yielded 5,488,947 pounds, worth $244,681; white-fish, 1,510,364 pounds, worth $73,492; yellow perch, 3,077,741 pounds, worth $57,972. Other important items were Menominee worth $14,307, and bluefin worth $12,794, all other products being represented by lower values.

To the vessel fisheries are credited 10,383,011 pounds of products, valued at $351,199, and to the shore fisheries, 24,116,985 pounds, valued at $525,544.

More than 90 per cent of the catch in Lake Michigan is taken in pound nets and gill nets, the yield of the former being 16,947,029 pounds, valued at $338,862, and of the latter, 14,517,998 pounds, valued at $470,573.

As compared with 1893, the year when these fisheries were last canvassed, it appears that a decrease of 673 has occurred in the number of persons employed, a falling off having taken place in the number engaged in the shore fisheries. During the same period there has been an increase in the investment in the fisheries of this lake amounting to $851,744, owing principally to the large amount of capital now invested in the wholesale fish trade of Chicago.

In comparing the yield of the fisheries it may be noted that the quantity of fish taken is now greater than in any other year for which statistics are available. With the exception of the year 1885 the same is true of the value of the catch.

Since 1893 there has been a slight increase in number and value of pound nets, and a corresponding decrease in number and value of gill nets. While the vessels employed in the fisheries have increased slightly in number there has been a noteworthy decrease in their value.

Since 1893 the products of this lake have increased 3,752,241 pounds in quantity and $48,132 in value, owing to an increase in the catch of herring. During this period, however, there has been a falling off in the catch of practically all other species. With respect to white-fish and trout, which have always been important species in the fisheries of this lake, there has been a diminution of 819,696 pounds of the former and 2,727,973 pounds of the latter.

It appears that the choice species of fish entering into the yield of Lake Michigan are much less in quantity than in earlier years, while a very large increase has occurred in the catch of cheaper varieties.

Statistics.—The following tables exhibit by States and counties the extent of the fisheries of Lake Michigan in 1899:

Table showing, by States and counties, the number of persons employed in the fisheries of Lake Michigan in 1899.

States and counties.	On vessels fishing.	On vessels transporting.	In shore fisheries.	Shoresmen.	Total.
Michigan:					
Allegan			30		30
Antrim			6		6
Benzie	16		14		30
Berrien	41		42	12	95
Charlevoix	70		142	21	233
Delta			96	5	101
Emmet	12		60	15	87
Grand Traverse			20		20
Leelanaw			95		95
Mackinac			139	1	140
Manistee			28		28
Mason	14		10	5	29
Menominee			163	12	175
Muskegon			29		29
Oceana			9		9
Ottawa	34		28	82	144
Schoolcraft	21		39	17	77
Van Buren			2		2
Total	208		952	170	1,330
Indiana:					
Lake			11		11
Laporte	8		19	6	33
Porter			12		12
Total	8		42	6	56
Illinois:					
Cook	13		270	376	659
Lake	7		16	3	26
Total	20		286	379	685
Wisconsin:					
Brown		2	108	67	202
Door	25	8	324	33	365
Kenosha	7		2	2	11
Kewaunee	6		8	5	19
Manitowoc	43		41	24	108
Marinette			92	2	94
Milwaukee	60		49	22	131
Oconto			111	7	118
Ozaukee	23		7	10	40
Racine	5		8	3	16
Sheboygan	48		15	17	80
Total	217	10	765	192	1,184
Grand total	453	10	2,045	747	3,255

Table showing, by States and counties, the apparatus and capital employed in the fisheries of Lake Michigan in 1899.

States and counties.	Vessels fishing.				Vessels transporting.				Boats.	
	No.	Tonnage.	Value.	Value of outfit.	No.	Tonnage.	Value.	Value of outfit.	No.	Value.
Michigan:										
Allegan									11	$601
Antrim									3	130
Benzie	3	28	$2,400	$1,221					8	735
Berrien	7	108	12,200	3,768					13	692
Charlevoix	12	181	29,600	7,426					49	3,425
Delta									84	6,186
Emmet	2	52	6,000	1,634					27	2,090
Grand Traverse									7	155
Leelanaw									47	2,370
Mackinac									74	5,348
Manistee									12	906
Mason	2	47	5,500	1,550					5	425
Menominee									130	5,644
Muskegon									10	325
Oceana									4	160
Ottawa	5	83	15,000	5,011					10	456
Schoolcraft	2	60	7,500	1,170					35	1,957
Van Buren									2	20
Total	33	559	78,200	21,780					531	31,625
Indiana:										
Lake									11	445
Laporte	1	53	6,000	450					13	305
Porter									10	445
Total	1	53	6,000	450					34	1,195
Illinois:										
Cook	3	39	8,000	435					28	1,740
Lake	1	19	2,500	1,500					9	405
Total	4	58	10,500	1,935					37	2,145
Wisconsin:										
Brown					1	18	$800	$40	114	4,682
Door	5	46	7,950	1,570	3	89	2,900	170	184	12,533
Kenosha	1	14	3,000	500					2	140
Kewaunee	1	5	1,000	135					5	480
Manitowoc	7	86	19,400	3,290					30	3,532
Marinette									33	1,977
Milwaukee	10	174	31,550	4,455					25	1,960
Oconto									80	5,206
Ozaukee	4	57	14,450	2,100					4	1,028
Racine	1	14	3,000	600					4	620
Sheboygan	9	148	35,250	3,880					15	845
Total	38	544	115,600	16,530	4	107	3,700	210	496	33,003
Grand total	76	1,214	210,300	40,695	4	107	3,700	210	1,098	67,968

States and counties.	Apparatus of capture—vessel fisheries.					Apparatus of capture—shore fisheries.			
	Pound nets.		Gill nets.		Value of lines.	Pound nets.		Gill nets.	
	No.	Value.	No.	Value.		No.	Value.	No.	Value.
Michigan:									
Allegan						8	$1,000	237	$1,135
Antrim								49	210
Benzie			614	$2,800		6	1,359	475	1,700
Berrien			4,972	19,642	$70	8	1,525	106	444
Charlevoix	7	$1,400	4,168	26,545		49	6,825	1,352	8,704
Delta						84	15,695	890	3,958
Emmet			720	5,397		19	3,600	716	3,938
Grand Traverse						6	675	53	185
Leelanaw						29	3,430	1,027	4,438
Mackinac						67	12,860	666	2,885
Manistee						2	325	1,167	3,887
Mason			364	3,876				636	2,980
Menominee						93	30,840	208	688
Muskegon						6	730	164	267
Oceana						4	600	100	300
Ottawa			2,496	12,067		5	515	616	2,145
Schoolcraft	3	640	2,130	20,825		30	7,660	259	1,206
Van Buren								7	28
Total	10	2,040	15,464	91,152	70	416	87,639	8,728	39,098

Table showing, by States and counties, the apparatus and capital employed in the fisheries of Lake Michigan in 1899—Continued.

States and counties.	Apparatus of capture—vessel fisheries.					Apparatus of capture—shore fisheries.			
	Pound nets.		Gill nets.		Value of lines.	Pound nets.		Gill nets.	
	No.	Value.	No.	Value.		No.	Value.	No.	Value.
Indiana:									
Lake						5	$1,380	30	$150
Laporte			750	$5,250		7	2,375	80	450
Porter						3	920	25	125
Total			750	5,250		15	4,675	135	725
Illinois:									
Cook			295	2,260				548	2,270
Lake			1,074	6,520		5	1,385	165	940
Total			1,369	8,780		5	1,385	713	3,210
Wisconsin:									
Brown						8	1,560	390	2,013
Door			2,490	11,910		118	31,545	5,757	21,007
Kenosha			300	1,400				18	70
Kewaunee			122	1,405	$85	2	350	439	2,396
Manitowoc			605	20,865		27	10,200	1,460	7,510
Marinette						36	7,665	1,017	2,926
Milwaukee			5,658	28,010				748	3,060
Oconto						145	26,815	946	1,612
Ozaukee			1,321	12,770		5	2,600	12	86
Racine			252	1,460				554	1,820
Sheboygan			609	19,860	325	18	9,875		
Total			11,357	97,680	410	359	90,610	11,341	42,500
Grand total	10	$2,040	*28,940	202,862	480	795	184,309	*20,917	85,533

Apparatus of capture—shore fisheries—continued.

States and counties.	Fyke nets.		Seines.		Dip nets.		Value of lines.	Crawfish pots.		Spears.	
	No.	Value.	No.	Value.	No.	Value.		No.	Value.	No.	Value.
Michigan:											
Allegan							$64				
Berrien							29				
Charlevoix			5	$250							
Delta	60	$840	4	205			960				
Grand Traverse			1	15							
Leelanaw							7				
Mackinac							15			15	$6
Menominee							5				
Schoolcraft			1	40			60				
Total	60	840	11	510			1,140			15	6
Indiana:											
Lake							16				
Laporte							80				
Porter							48				
Total							144				
Illinois:											
Cook					220	$1,710	256				
Lake	12	180					40				
Total	12	180			220	1,710	296				
Wisconsin:											
Brown	1,047	13,855						2,870	$784		
Door							840				
Kewaunee							48				
Marinette	28	380									
Milwaukee							210				
Oconto	330	8,372									
Total	1,405	22,607					1,098	2,870	784		
Grand total	1,477	23,627	11	510	220	1,710	2,678	2,870	784	15	6

*Length of gill nets, 5,603,064 yards.

Table showing, by States and counties, the apparatus and capital employed in the fisheries of Lake Michigan in 1899—Continued.

States and counties.	Shore and accessory property.	Cash capital.	Total investment.	States and counties.	Shore and accessory property.	Cash capital.	Total investment.
Michigan:				Indiana:			
Allegan	$585		$3,385	Lake	$575		$2,566
Antrim	95		435	Laporte	8,800	$5,000	28,710
Benzie	3,963		14,178	Porter	400		1,938
Berrien	19,852		58,222	Total	9,775	5,000	33,214
Charlevoix	10,340		94,515				
Delta	7,380	$2,500	37,724				
Emmet	8,185		30,844				
Grand Traverse	785		1,815	Wisconsin:			
Leelanaw	4,046		14,291	Brown	32,906	44,000	100,640
Mackinac	4,505		25,619	Door	15,840	8,000	114,265
Manistee	869		5,987	Kenosha	350		5,460
Mason	2,773		17,104	Kewaunee	680		6,579
Menominee	5,665		42,842	Manitowoc	5,510	200	70,507
Muskegon	285		1,607	Marinette	2,261		15,209
Oceana	200		1,260	Milwaukee	4,000		73,245
Ottawa	12,419	10,000	57,613	Oconto	7,470		49,475
Schoolcraft	6,720	1,000	48,778	Ozaukee	3,700		36,734
Van Buren	20		68	Racine	400		7,900
				Sheboygan	4,350		74,385
Total	88,687	13,500	456,287	Total	77,467	52,200	554,399
Illinois:							
Cook	693,000	1,147,500	1,857,171	Grand total	869,629	1,218,200	2,915,241
Lake	700		14,170				
Total	693,700	1,147,500	1,871,341				

Table showing, by States and counties, the yield of the fisheries of Lake Michigan in 1899.

States and counties.	Black bass.		German carp.		Cat-fish and bullheads.		Eels.		Ling or lawyers.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Michigan:										
Allegan			4,757	$48					485	$5
Berrien			3,089	62			100	$10		
Delta	3,378	$261			98	$3				
Emmet	500	40								
Mackinac	1,082	81								
Muskegon			284	6					236	8
Ottawa			680	10						
Total	4,960	382	8,810	126	98	3	100	10	721	13
Indiana:										
Lake			520	7					100	1
Laporte	250	18	845	12			84	6	1,362	14
Porter			350	5					600	6
Total	250	18	1,715	24			84	6	2,062	21
Illinois:										
Cook			3,150	110			300	24	9,200	92
Lake									25,156	252
Total			3,150	110			300	24	34,356	344
Wisconsin:										
Brown	2,595	193	10,675	157	51,654	1,361				
Door	560	37			2,680	93				
Kenosha									8,000	80
Marinette					60	3				
Milwaukee			450	12					72,500	404
Oconto	200	14	480	63	7,670	222				
Ozaukee									1,200	12
Racine									3,500	12
Total	3,355	244	11,605	232	62,064	1,679			85,200	508
Grand total	8,565	644	25,280	492	62,162	1,682	484	40	122,339	886

Table showing, by States and counties, the yield of the fisheries of Lake Michigan in 1899—Continued.

States and counties.	Herring, fresh.		Herring, salted.		Trout, fresh.		Trout, salted.		Yellow perch.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.
Michigan:										
Allegan	8,437	$128			2,802	$89	44	$2	101,702	$2,172
Antrim					8,750	498				
Benzie	11,130	286			181,750	7,628				
Berrien	532,596	12,353	9,000	$540	259,650	11,753			39,255	1,156
Charlevoix	426,178	9,057	16,263	843	800,339	27,717	37,892	1,544	47,497	700
Delta	43,682	573	213,700	4,144	139,042	5,914	1,600	74	19,422	371
Emmet	3,968	69	300	11	209,589	8,074			14,000	320
Grand Traverse	2,000	59			6,408	291			300	6
Leelanaw	600	23	300	15	97,378	3,283	26,701	1,254		
Mackinac	182,710	2,255			169,715	7,976			14,053	253
Manistee	18,880	480			79,606	2,954				
Mason	214,253	5,315			86,386	3,545				
Menominee	217,900	2,379	5,929,400	114,287	22,760	1,013	5,600	274	6,520	106
Muskegon	10,204	230			36,875	1,685			2,190	81
Oceana	44,534	598			16,591	744			53	2
Ottawa	1,270,712	31,038			100,664	4,031			30,170	767
Schoolcraft	20,050	301			282,807	14,873				
Van Buren	150	2							10,000	250
Total	3,007,984	65,146	6,168,963	119,840	2,501,112	102,098	71,837	3,148	285,162	6,184
Indiana:										
Lake	27,100	529			3,500	180			27,400	678
Laporte	232,705	6,477			28,952	1,706			139,540	3,275
Porter	11,950	215			2,560	141			40,330	977
Total	271,755	7,221			35,012	2,027			207,270	4,930
Illinois:										
Cook	139,640	3,520			9,700	520			550,600	18,696
Lake	215,165	6,383			66,828	3,983			127,115	3,130
Total	354,805	9,903			76,528	4,503			677,715	21,826
Wisconsin:										
Brown	276,925	4,060	22,000	386	550	27			1,131,274	12,776
Door	1,051,248	14,254	3,750,800	66,367	878,334	36,920	10,000	518	239,665	3,249
Kenosha	158,040	4,296			17,850	865			13,200	480
Kewaunee	43,550	1,044	11,000	220	73,977	3,947			1,650	23
Manitowoc	1,073,951	29,568	65,800	1,164	558,444	22,811			3,220	76
Marinette	602,400	6,752	477,800	8,879	8,220	488			77,520	1,008
Milwaukee	812,975	24,646			412,655	23,308			60,600	1,963
Oconto	1,171,195	13,291	851,700	15,389	1,920	98			357,165	4,778
Ozaukee	448,493	13,485			267,668	13,251			6,450	156
Racine	101,780	3,252			97,200	5,838			9,600	335
Sheboygan	850,552	24,866			477,640	24,834			7,250	188
Total	6,591,109	139,514	5,179,100	92,405	2,794,458	132,387	10,000	518	1,907,594	25,032
Grand total	10,225,653	221,784	11,348,063	212,245	5,407,110	241,015	81,837	3,666	3,077,741	57,972

States and counties.	Pike and pickerel.		Rock bass.		Pike perch (wall-eyed), fresh.		Pike perch (wall-eyed), salted.		White bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Michigan:										
Allegan	752	$40								
Benzie					507	$22				
Charlevoix			161	$5						
Delta	17,622	813			100,423	4,145				
Mackinac	1,551	85			1,467	76				
Manistee	472	24			472	24				
Muskegon					424	34			118	$8
Ottawa	134	6			153	8			42	2
Schoolcraft	350	14								
Total	20,881	982	161	5	103,446	4,309			160	10
Indiana:										
Lake	100	12							200	8
Laporte	184	12							300	12
Porter	72	5							120	5
Total	356	29							620	25
Wisconsin:										
Brown	40,528	2,038	4,000	38	32,552	1,481			3,200	96
Door	8,998	487			20,035	878	400	$22		
Marinette	2,030	112			2,700	132				
Oconto	14,640	851			14,600	733			400	15
Total	66,196	3,488	4,000	38	69,887	3,224	400	22	3,600	111
Grand total	87,433	4,499	4,161	43	173,333	7,533	400	22	4,380	146

Table showing, by States and counties, the yield of the fisheries of Lake Michigan in 1899—Continued.

States and counties.	White-fish, fresh.		White-fish, salted.		White-fish (bluefin), fresh.		White-fish (bluefin), salted.		White-fish (Menominee), fresh.		White-fish (Menominee), salted.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Michigan:												
Allegan	9,684	$424										
Antrim	3,540	185					3,100	$155				
Benzie	187,995	8,549	8,000	$400	15,221	$410						
Berrien	12,486	688										
Charlevoix	466,105	20,911	40,340	2,110	3,929	102			1,534	$20	44,030	$1,111
Delta	88,971	4,797	2,300	138					44,833	1,338		
Emmet	190,354	8,853	1,945	46	590	15			1,136	37		
Grand Traverse	14,565	847										
Leelanaw	110,041	4,412	48,237	2,616	22,727	533	2,820	121				
Mackinac	64,502	3,266							103,160	2,686	24,800	812
Manistee	8,448	358			19,593	493						
Mason					100,417	2,294						
Menominee	5,865	412	2,400	157	27,410	685						
Muskegon	796	46										
Oceana	2,752	140			826	21						
Ottawa	201	9			51,530	1,295						
Schoolcraft	182,149	10,320			451	21			41,670	1,074		
Total	1,348,454	64,217	103,222	5,467	242,694	5,869	5,920	276	192,333	5,155	68,830	1,923
Indiana:												
Lake	2,950	182										
Laporte	5,368	336										
Porter	2,040	130										
Total	10,358	648										
Illinois:												
Lake	200	10										
Wisconsin:												
Brown	33,040	2,020			158,000	4,010			125,465	3,141	75,200	2,637
Kewaunee	50	4							55,005	1,383		
Manitowoc	2,475	176			55,624	1,589			2,250	68		
Marinette	1,510	86			12,800	320						
Oconto	3,135	234										
Ozaukee	3,080	238			8,593	261						
Sheboygan	4,840	392			14,687	469						
Total	48,130	3,150			249,704	6,649			182,720	4,592	75,200	2,637
Grand total	1,407,142	68,025	103,222	5,467	492,398	12,518	5,920	276	375,053	9,747	144,030	4,560

States and counties.	Fresh-water drum.		Sturgeon.		Suckers, fresh.		Suckers, salted.		Crawfish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Michigan:										
Allegan	740	$7	14,295	$1,544	2,653	$22	831	$7		
Benzie			664	24			3,600	63		
Berrien	4,160	42	10,243	870	41,559	1,189				
Charlevoix			596	18	1,300	16	14,705	152		
Delta			21,710	1,257	230,226	2,283				
Emmet			218	7						
Leelanaw			24	6			9,600	183		
Mackinac			7,727	347	20,800	249				
Manistee			5,160	400						
Menominee			2,050	94	7,000	70	62,800	1,196		
Muskegon	8,000	60	4,656	294	15,930	205				
Oceana			3,395	451	4,668	40				
Ottawa	9,245	92	2,460	192	10,287	89				
Schoolcraft			2,859	124	14,650	206				
Total	22,145	201	76,057	5,628	349,073	4,369	91,536	1,601		
Indiana:										
Lake	8,850	133	4,050	190	5,550	84				
Laporte	18,127	282	8,775	409	4,280	54				
Porter	6,250	106	4,822	232	2,704	51				
Total	33,227	521	17,647	831	12,534	189				
Illinois:										
Cook					1,500	40				
Lake					39,555	524				
Total					41,055	564				
Wisconsin:										
Brown			350	16	305,450	2,625			135,861	$3,498
Door			5,420	259	56,930	604				
Kewaunee					6,550	78				
Manitowoc			1,670	109	2,950	32				
Marinette			2,450	98	15,850	168	13,600	258		
Milwaukee					3,000	60				
Oconto			3,550	162	127,600	1,294	4,000	72		
Ozaukee			250	20	2,200	24				
Sheboygan			885	64	11,450	136				
Total			14,575	728	531,980	5,021	17,600	330	135,861	3,498
Grand total	55,372	722	108,279	7,187	934,642	10,143	109,136	1,931	135,861	3,498

Summary of the yield of the fisheries of Lake Michigan in 1899.

States and counties.	Lbs.	Value.	States and counties.	Lbs.	Value.
Michigan:			Indiana:		
Allegan	147,182	$4,488	Lake	80,320	$2,004
Antrim	15,390	838	Laporte	440,772	12,613
Benzie	408,867	17,382	Porter	71,798	1,873
Berrien	912,138	28,663			
Charlevoix	1,900,869	64,336	Total	592,890	16,490
Delta	927,007	26,111			
Emmet	422,600	17,472	Wisconsin:		
Grand Traverse	23,273	1,203	Brown	2,017,614	28,752
Leelanaw	318,428	12,446	Door	6,416,775	135,496
Mackinac	591,567	18,086	Kenosha	197,090	5,721
Manistee	132,631	4,733	Kewaunee	191,782	6,699
Mason	401,056	11,154	Manitowoc	1,766,384	55,593
Menominee	6,289,705	120,673	Marinette	1,216,940	18,304
Muskegon	79,713	2,657	Milwaukee	1,362,180	50,393
Oceana	72,819	1,996	Oconto	2,558,255	37,216
Ottawa	1,476,278	37,539	Ozaukee	737,934	27,447
Schoolcraft	544,986	26,933	Racine	212,080	9,437
Van Buren	10,150	252	Sheboygan	1,367,304	50,949
Total	14,674,659	396,962	Total	18,044,338	426,007
Illinois:					
Cook	714,090	23,002	Grand total	34,499,996	876,743
Lake	474,019	14,282			
Total	1,188,109	37,284			

Table showing, by States, counties, apparatus, and species, the yield of the vessel fisheries of Lake Michigan in 1899.

Apparatus and species.	Indiana.		Illinois.					
	Laporte.		Cook.		Lake.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:								
Herring, fresh	187,651	$5,675	6,680	$170	150,095	$4,538	156,775	$4,708
Ling or lawyers			200	2	7,156	72	7,356	74
Sturgeon	45	3						
Suckers, fresh					2,295	36	2,295	36
Trout	24,578	1,454	4,500	260	65,628	3,923	70,128	4,183
Yellow perch	9,790	245	68,500	1,766	6,035	157	74,535	1,923
Total	222,064	7,377	79,880	2,198	231,209	8,726	311,089	10,924
Grand total	222,064	7,377	79,880	2,198	231,209	8,726	311,089	10,924

Apparatus and species.	Michigan.							
	Benzie.		Berrien.		Charlevoix.		Emmet.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Herring, salted					3,000	$30		
Suckers, salted					600	6		
Trout					34,950	1,246		
White-fish, fresh					34,404	1,558		
Total					72,954	2,840		
Gill nets:								
Herring, fresh	10,352	$264	526,653	$12,238	426,113	9,055	3,968	$69
Herring, salted			9,000	540				
Sturgeon					113	4		
Suckers, fresh			36,000	1,080				
Suckers, salted	3,000	52						
Trout	132,500	5,555	258,473	11,706	628,657	21,919	115,964	4,581
White-fish, fresh	111,764	5,225	2,353	200	255,329	11,692	59,089	3,019
White-fish, salted					2,000	80	1,445	22
White-fish (bluefin)	12,118	309						
Yellow perch					1,470	29		
Total	269,734	11,405	832,479	25,764	1,313,682	42,779	180,466	7,691
Lines:								
Sturgeon			40	2				
Yellow perch			20,000	600				
Grand total	269,734	11,405	852,519	26,366	1,386,636	45,619	180,466	7,691

Table showing, by States, counties, apparatus, and species, the yield of the vessel fisheries of Lake Michigan in 1899—Continued.

Apparatus and species.	Michigan—continued. Mason.		Ottawa.		Schoolcraft.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Herring, salted							3,000	$30
Sturgeon					55	$3	55	3
Suckers, salted							600	6
Trout					220	11	35,170	1,257
White-fish, fresh					12,140	728	46,544	2,286
Total					12,415	742	85,369	3,582
Gill nets:								
Herring, fresh	194,889	$4,905	1,127,319	$28,248			2,289,294	54,779
Herring, salted							9,000	540
Sturgeon							113	4
Suckers, fresh							36,000	1,080
Suckers, salted							3,000	52
Trout	39,175	1,845	86,743	3,469	236,972	12,776	1,498,484	61,851
White-fish, fresh					67,263	3,910	495,798	24,046
White-fish, salted							3,445	102
White-fish (bluefin)	100,417	2,294	51,530	1,295	451	21	164,516	3,919
Yellow perch							1,470	29
Total	334,481	9,044	1,265,592	33,012	304,686	16,707	4,501,120	146,402
Lines:								
Sturgeon							40	2
Yellow perch							20,000	600
Total							20,040	602
Grand total	334,481	9,044	1,265,592	33,012	317,101	17,449	4,606,529	150,586

Apparatus and species.	Wisconsin. Door.		Kenosha.		Kewaunee.		Manitowoc.		Milwaukee.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:										
Herring, fresh	206,815	$4,655	154,540	$4,236	22,950	$803	943,756	$27,329	774,155	$23,574
Ling or lawyers			8,000	80					43,200	186
Trout	310,355	12,775	17,850	865	8,412	418	275,154	8,897	351,365	20,072
White-fish, fresh	11,610	730								
White-fish (bluefin)							55,621	1,589		
White-fish (Menominee)	10,500	270			2,355	67				
Total	539,280	18,430	180,390	5,181	33,717	1,288	1,274,534	37,815	1,168,720	43,832
Lines:										
Trout					4,865	291				
Grand total	539,280	18,430	180,390	5,181	38,582	1,579	1,274,534	37,815	1,168,720	43,832

Apparatus and species.	Wisconsin—continued. Ozaukee.		Racine.		Sheboygan.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:								
Herring, fresh	430,863	$13,181	73,000	$2,190	834,152	$24,571	3,440,231	$100,539
Ling or lawyers			3,500	12			54,700	278
Trout	235,143	11,526	85,000	5,042	238,025	11,618	1,521,304	71,213
White-fish, fresh					1,860	103	13,470	833
White-fish (bluefin)	8,593	261			14,687	469	78,904	2,319
White-fish (Menominee)							12,855	337
Total	674,599	24,968	161,500	7,244	1,088,724	36,761	5,121,464	175,519
Lines:								
Trout					117,000	6,502	121,865	6,793
Grand total	674,599	24,968	161,500	7,244	1,205,724	43,263	5,243,329	182,312

Summary showing the yield of the vessel fisheries of Lake Michigan in 1899.

Apparatus and species.	Lbs.	Value.	Apparatus and species.	Lbs.	Value.
Gill nets:			Pound nets:		
Herring, fresh	6,073,951	$165,701	Herring, salted	3,000	$30
Herring, salted	9,000	540	Sturgeon	55	3
Ling or lawyers	62,056	352	Suckers, salted	600	6
Sturgeon	158	7	Trout	35,170	1,257
Suckers, fresh	38,295	1,116	White-fish, fresh	46,544	2,286
Suckers, salted	3,000	52	Total	85,369	3,582
Trout	3,114,494	138,701	Lines:		
White-fish, fresh	509,268	24,879	Sturgeon	40	2
White-fish, salted	3,445	102	Trout	121,865	6,793
White-fish (bluefin)	243,420	6,238	Yellow perch	20,000	600
White-fish (Menominee)	12,855	337	Total	141,905	7,395
Yellow perch	85,795	2,197			
Total	10,155,737	340,222	Grand total	10,383,011	351,199

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Michigan in 1899.

Apparatus and species.	Michigan.							
	Allegan.		Antrim.		Benzie.		Berrien.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
German carp	757	$8					89	$2
Fresh-water drum	740	7					4,160	42
Herring, fresh	7,422	119					5,943	115
Pike and pickerel	752	40						
Pike perch (wall-eyed)					507	$22		
Sturgeon	11,620	1,312			664	24	10,203	868
Suckers, fresh	2,233	19					1,043	20
Suckers, salted	831	7						
Trout, fresh	625	20			5,031	260	1,177	47
Trout, salted	44	2						
White-fish, fresh	7,478	330			50,537	2,221	10,133	488
White-fish, salted					8,000	400		
Yellow perch	467	11					1,450	41
Total	32,969	1,875			64,739	2,927	34,198	1,623
Gill nets:								
German carp							3,000	60
Herring, fresh	1,015	9			778	22		
Sturgeon	150	6						
Suckers, fresh	420	3					4,516	89
Suckers, salted					600	11		
Trout, fresh	2,177	69	8,750	$498	44,219	1,813		
White-fish, fresh	2,206	94	3,540	185	25,694	1,103		
White-fish (bluefin), fresh					3,103	101		
White-fish (bluefin), salted			3,100	155				
Yellow perch	101,235	2,161					9,805	275
Total	107,203	2,342	15,390	838	74,394	3,050	17,321	424
Lines:								
German carp	4,000	40						
Eels							100	10
Ling or lawyers	485	5						
Sturgeon	2,525	226						
Yellow perch							8,000	240
Total	7,010	271					8,100	250
Grand total	147,182	4,488	15,390	838	139,133	5,977	59,619	2,297

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Michigan in 1899—Continued.

Apparatus and species.	Michigan—continued.									
	Charlevoix.		Delta.		Emmet.		Grand Traverse.		Leelanaw.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:										
Black bass			492	$41	500	$40				
Cat-fish and bullheads			98	3						
Herring, fresh			21,422	279			2,000	$59		
Herring, salted			213,700	4,144	300	11				
Pike and pickerel			13,380	630						
Pike perch (wall-eyed)			59,555	2,435						
Sturgeon	483	$14	21,434	1,241	186	6				
Suckers, fresh			226,888	2,208						
Suckers, salted	1,000	15							9,600	$183
Trout, fresh	50,364	1,612	53,182	2,241	13,750	420	2,261	64	13,058	448
Trout, salted			1,600	74					2,700	131
White-fish, fresh	130,582	5,532	58,767	3,238	99,759	4,449	10,781	655	67,006	2,746
White-fish, salted			2,300	138	500	24			39,976	2,162
White-fish (Menominee), fresh			5,235	140	900	32				
Yellow perch			4,700	61	2,000	50				
Total	182,429	7,173	682,753	16,873	117,895	5,032	15,042	778	132,340	5,670
Gill nets:										
Black bass			552	42						
Herring, fresh	65	2	21,860	288					600	23
Herring, salted	13,263	813							300	15
Pike and pickerel			1,506	65						
Pike perch (wall-eyed)			2,098	99						
Rock bass	161	5								
Sturgeon					32	1			24	6
Suckers, fresh			1,678	51						
Trout, fresh	86,368	2,970	41,240	1,826	79,875	3,073	4,147	227	79,945	2,660
Trout, salted	37,892	1,544							24,001	1,123
White-fish, fresh	45,790	2,129	29,604	1,528	31,506	1,385	3,784	192	43,035	1,666
White-fish, salted	38,340	2,030							8,261	454
White-fish (bluefin), fresh	3,929	102			590	15			22,727	533
White-fish (bluefin), salted									2,820	121
White-fish (Menominee), fresh	1,534	20	39,570	1,196	236	5				
White-fish (Menominee), salted	44,030	1,111								
Yellow perch	46,027	671	11,500	259	12,000	270				
Total	317,399	11,397	149,608	5,354	124,239	4,749	7,931	419	181,713	6,601
Seines:										
Herring			400	6						
Pike and pickerel			2,336	96						
Pike perch (wall-eyed)			37,980	1,570						
Sturgeon			276	16						
Suckers, fresh	1,300	16	900	14						
Suckers, salted	13,105	131								
White-fish			600	31						
Yellow perch			1,580	24			300	6		
Total	14,405	147	44,072	1,757			300	6		
Fyke nets:										
Black bass			2,334	178						
Pike and pickerel			400	22						
Pike perch (wall-eyed)			790	41						
Suckers			760	10						
White-fish (Menominee)			28	2						
Yellow perch			1,642	27						
Total			5,954	280						
Lines:										
Trout			44,620	1,847					4,375	175
Grand total	514,233	18,717	927,007	26,111	242,134	9,781	23,273	1,203	318,428	12,446

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Michigan in 1899—Continued.

Apparatus and species.	Michigan—continued.									
	Mackinac.		Manistee.		Mason.		Menominee.		Muskegon.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:										
Black bass	220	$16							8,000	$60
Fresh-water drum									284	6
German carp										
Herring, fresh	175,610	2,145					185,400	$1,982	9,260	182
Herring, salted							5,929,400	114,287		
Ling or lawyers									236	8
Pike and pickerel	951	55	472	$24						
Pike perch (wall-eyed)	1,467	76	472	24					424	34
Sturgeon	7,727	347	2,730	181			2,050	94	4,656	294
Suckers, fresh	19,850	239					4,500	45	15,930	205
Suckers, salted							62,800	1,196		
Trout, fresh	67,621	3,039					18,920	837	25,400	1,156
Trout, salted							5,600	274		
White bass									118	8
White-fish, fresh	57,622	2,891	4,602	195			5,865	412	796	46
White-fish, salted							2,400	157		
Yellow perch	8,856	112					6,520	106	2,190	81
Total	339,924	8,920	8,276	424			6,223,455	119,390	67,294	2,080
Gill nets:										
Black bass	862	65								
Herring, fresh	6,000	75	18,880	480	19,364	$410	32,500	397	944	48
Rock bass			2,430	219						
Sturgeon	950	10					2,500	25		
Trout, fresh	29,494	1,307	79,606	2,954	47,211	1,700	1,680	84	11,475	529
White-fish, fresh	6,880	375	3,846	163						
White-fish (bluefin), fresh			19,593	493			27,410	685		
White-fish (Menominee), fresh	103,160	2,686								
White-fish (Menominee), salted	24,800	812								
Yellow perch	3,357	49								
Total	175,503	5,379	124,355	4,309	66,575	2,110	64,090	1,191	12,419	577
Lines:										
Pike and pickerel	600	30								
Trout	68,200	3,410					2,160	92		
Total	68,800	3,440					2,160	92		
Spears:										
Herring	1,100	35								
Trout	4,100	220								
Yellow perch	1,840	92								
Total	7,340	347								
Grand total	591,567	18,086	132,631	4,733	66,575	2,110	6,289,705	120,673	79,713	2,657

Apparatus and species.	Michigan—continued.							
	Oceana.		Ottawa.		Schoolcraft.		Van Buren.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Fresh-water drum			9,245	$92				
German carp			680	10				
Herring, fresh	42,056	$535	46,648	443	11,650	$163		
Pike and pickerel			134	6				
Pike perch (wall-eyed)			153	8				
Sturgeon	3,395	451	2,460	192	2,264	97		
Suckers, fresh	4,668	40	9,107	79	7,450	96		
Trout, fresh	10,091	484	1,502	54	34,890	1,522		
White bass			42	2				
White-fish, fresh	2,752	140	201	9	75,786	5,261		
Yellow perch	53	2	3,030	77				
Total	63,015	1,652	73,202	972	152,040	7,142		

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Michigan in 1899—Continued.

Apparatus and species.	Michigan—continued.							
	Oceana.		Ottawa.		Schoolcraft.		Van Buren.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Herring					1,000	$16		
Pike and pickerel					350	14		
Suckers, fresh					7,200	110		
Total					8,550	140		
Gill nets:								
German carp	2,478	$63	96,745	$2,347	7,400	122	150	$2
Sturgeon					540	24		
Suckers, fresh			1,180	10				
Trout, fresh	6,500	260	12,419	508	6,525	324		
White-fish, fresh					6,960	418		
White-fish (bluefin), fresh	826	21						
White-fish (Menominee), fresh					41,670	1,074		
Yellow perch			27,140	690			10,000	250
Total	9,804	344	137,484	3,555	63,095	1,962	10,150	252
Lines:								
Sturgeon					4,200	240		
Grand total	72,819	1,996	210,686	4,527	227,885	9,484	10,150	252

Apparatus and species.	Total for Michigan.	
	Lbs.	Value.
Pound nets:		
Black bass	1,212	$97
Fresh-water drum	22,145	201
Cat-fish and bullheads	98	3
German carp	1,810	26
Herring, fresh	507,411	6,022
Herring, salted	6,143,400	118,442
Ling or lawyers	236	8
Pike and pickerel	15,689	755
Pike perch (wall-eyed)	62,578	2,599
Sturgeon	69,872	5,121
Suckers, fresh	291,669	2,951
Suckers, salted	74,231	1,401
Trout, fresh	297,872	12,204
Trout, salted	9,944	481
White bass	160	10
White-fish, fresh	602,667	28,616
White-fish, salted	53,176	2,881
White-fish (Menominee), fresh	6,135	172
Yellow perch	29,266	541
Total	8,189,571	182,531
Seines:		
Herring	1,400	22
Pike and pickerel	2,686	110
Pike perch (wall-eyed)	37,980	1,570
Sturgeon	276	16
Suckers, fresh	9,400	140
Suckers, salted	13,105	131
White-fish	600	31
Yellow perch	1,880	30
Total	67,327	2,050
Fyke nets:		
Black bass	2,334	178
Pike and pickerel	400	22
Pike perch (wall-eyed)	790	41
Suckers	760	10
White-fish (Menominee)	28	2
Yellow perch	1,642	27
Total	5,954	280

Apparatus and species.	Total for Michigan.	
	Lbs.	Value.
Gill nets:		
Black bass	1,414	$107
German carp	3,000	60
Herring, fresh	208,779	4,288
Herring, salted	13,563	828
Pike and pickerel	1,506	65
Pike perch (wall-eyed)	2,098	99
Rock bass	161	5
Sturgeon	3,176	256
Suckers, fresh	11,244	188
Suckers, salted	600	11
Trout, fresh	541,631	20,802
Trout, salted	61,893	2,667
White-fish, fresh	202,845	9,238
White-fish, salted	46,601	2,484
White-fish (bluefin), fresh	78,178	1,950
White-fish (bluefin), salted	5,920	276
White-fish (Menominee), fresh	186,170	4,981
White-fish (Menominee), salted	68,830	1,923
Yellow perch	221,064	4,625
Total	1,658,673	54,853
Lines:		
German carp	4,000	40
Eels	100	10
Ling or lawyers	485	5
Pike and pickerel	600	30
Sturgeon	2,525	226
Trout	123,555	5,764
Yellow perch	8,000	240
Total	139,265	6,315
Spears:		
Herring	1,100	35
Trout	4,400	220
Yellow perch	1,840	92
Total	7,340	347
Grand total	10,068,130	246,376

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Michigan in 1899—Continued.

Apparatus and species.	Indiana.							
	Lake.		Laporte.		Porter.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Black bass			250	$18			250	$18
Eels			84	6			84	6
German carp	520	$7	845	12	350	$5	1,715	24
Fresh-water drum	8,850	133	18,127	282	6,250	106	33,227	521
Herring	24,500	465	22,654	370	8,100	148	55,254	983
Ling or lawyers			162	2			162	2
Pike and pickerel	100	12	184	12	72	5	356	29
Sturgeon	3,850	178	8,130	370	4,242	198	16,222	746
Suckers	4,300	59	4,280	54	1,704	31	10,284	144
Trout	2,800	145	4,174	240	1,660	96	8,634	481
White bass	200	8	300	12	120	5	620	25
White-fish	2,950	182	5,368	336	2,040	130	10,358	648
Yellow perch	19,800	450	67,430	1,422	18,970	397	106,200	2,269
Total	67,870	1,639	131,988	3,136	43,508	1,121	243,366	5,896
Gill nets:								
Herring	2,600	64	22,400	432	3,850	67	28,850	563
Suckers	1,250	25			1,000	20	2,250	45
Trout	600	30			500	25	1,100	55
Yellow perch	4,000	120	36,240	906	9,800	270	50,040	1,296
Total	8,450	239	58,640	1,338	15,150	382	82,240	1,959
Lines:								
Ling or lawyers	100	1	1,200	12	600	6	1,900	19
Sturgeon	200	12	600	36	580	34	1,380	82
Trout	100	5	200	12	400	20	700	37
Yellow perch	3,600	108	26,080	702	11,560	310	41,240	1,120
Total	4,000	126	28,080	762	13,140	370	45,220	1,258
Grand total	80,320	2,004	218,708	5,236	71,798	1,873	370,826	9,113

Apparatus and species.	Illinois.					
	Cook.		Lake.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:						
Herring			3,000	$80	3,000	$80
Suckers			4,000	75	4,000	75
Trout			1,200	60	1,200	60
White-fish			200	10	200	10
Yellow perch			11,000	318	11,000	318
Total			19,400	543	19,400	543
Gill nets:						
Herring	68,960	$1,750	62,070	1,765	131,030	3,515
Ling or lawyers	4,000	40	18,000	180	22,000	220
Suckers	1,500	40	33,260	413	34,760	453
Trout	5,200	260			5,200	260
Yellow perch	114,500	4,010	84,960	1,985	199,460	5,995
Total	194,160	6,100	198,290	4,343	392,450	10,443
Fyke nets:						
Yellow perch			8,260	228	8,260	228
Dip nets:						
German carp	3,150	110			3,150	110
Herring	64,000	1,600			64,000	1,600
Yellow perch	265,000	9,275			265,000	9,275
Total	332,150	10,985			332,150	10,985
Lines:						
Eels	300	24			300	24
Ling or lawyers	5,000	50			5,000	50
Yellow perch	102,600	3,645	16,860	442	119,460	4,087
Total	107,900	3,719	16,860	442	124,760	4,161
Grand total	634,210	20,804	242,810	5,556	877,020	26,360

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Michigan in 1899—Continued.

Apparatus and species.	Wisconsin.							
	Brown.		Door.		Kenosha.		Kewaunee.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Cat-fish and bullheads			2,680	$93				
Herring, fresh	69,620	$824	722,530	7,880			13,600	$150
Herring, salted	22,000	386	3,750,800	66,367			11,000	220
Pike and pickerel	2,200	120	8,598	467				
Pike perch (wall-eyed), fresh	500	25	17,785	766				
Pike perch (wall-eyed), salted			400	22				
Sturgeon	350	16	5,420	259				
Suckers, fresh	15,000	170	48,250	500			50	1
Trout, fresh			77,490	3,157			300	18
Trout, salted			10,000	518				
White-fish, fresh			4,850	282			50	4
White-fish (Menominee), fresh			2,050	65				
White-fish (Menominee), salted			3,900	140				
Yellow perch	32,725	528	136,825	1,709			250	5
Total	142,395	2,069	4,791,578	82,225			25,250	398
Gill nets:								
Black bass			560	37				
Herring, fresh	167,305	2,706	89,903	1,319	3,500	$60	7,000	91
Pike and pickerel	5,200	248	400	20				
Pike perch (wall-eyed)	1,500	82						
Suckers, fresh	5,000	65	8,680	104			6,500	77
Trout, fresh	250	12	366,965	16,299			58,000	3,028
White-fish, fresh			16,580	1,008				
White-fish (bluefin), fresh			158,000	4,010				
White-fish (Menominee), fresh			112,915	2,806			52,650	1,316
White-fish (Menominee), salted			71,300	2,497				
Yellow perch	58,780	894	13,040	200	13,200	480	1,400	18
Total	238,035	4,007	838,343	28,300	16,700	540	125,550	4,530
Fyke nets:								
Black bass	2,595	193						
Cat-fish and bullheads	51,654	1,361						
German carp	10,675	157						
Herring	40,000	530						
Pike and pickerel	33,128	1,670						
Pike perch (wall-eyed)	30,552	1,374						
Rock bass	4,000	38						
Suckers	285,450	2,390						
Trout	300	15						
White bass	3,200	96						
Yellow perch	1,039,769	11,354						
Total	1,501,323	19,178						
Lines:								
Herring			32,000	400				
Trout			123,524	4,689			2,400	192
Pike perch (wall-eyed)			2,250	112				
Yellow perch			89,800	1,340				
Total			247,574	6,541			2,400	192
Crawfish pots:								
Crawfish	135,861	3,498						
Grand total	2,017,614	28,752	5,877,495	117,066	16,700	540	153,200	5,120

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Michigan in 1899—Continued.

Apparatus and species.	Wisconsin—continued.							
	Manitowoc.		Marinette.		Milwaukee.		Oconto.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Cat-fish and bullheads							3,500	$105
Herring, fresh	76,950	$787	291,000	$2,836			930,550	10,193
Herring, salted	65,800	1,164	477,800	8,879			851,700	15,389
Pike and pickerel			850	48			7,780	475
Pike perch (wall-eyed), fresh							8,350	385
Sturgeon	1,670	109	2,450	98			3,550	162
Suckers, fresh	2,950	32	8,950	85			90,500	907
Suckers, salted			13,600	258			4,000	72
Trout, fresh	119,200	5,958	710	37			1,600	80
White-fish, fresh	2,225	160	1,480	84			200	16
Yellow perch	1,620	44	31,950	442			241,030	3,003
Total	270,415	8,254	828,790	12,767			2,142,760	30,787
Gill nets:								
German carp					450	$12		
Herring, fresh	53,245	1,452	308,400	3,880	38,820	1,072	212,045	2,774
Ling or lawyers					11,000	98		
Suckers, fresh			1,500	20	3,000	60	5,000	60
Trout, fresh	164,090	7,956	7,460	448	61,290	3,236		
White-fish, fresh	250	16					2,935	218
White-fish (bluefin), fresh			12,800	320				
White-fish (Menominee), fresh	2,250	68						
Yellow perch	1,600	32	11,500	132	29,200	995	16,075	322
Total	221,435	9,524	341,660	4,800	143,760	5,473	236,055	3,374
Fyke nets:								
Black bass							200	14
Cat-fish and bullheads			60	3			4,170	117
German carp							480	63
Herring			3,000	36			28,600	324
Pike and pickerel			1,180	64			6,860	376
Pike perch (wall-eyed)			2,700	132			6,250	348
Suckers			5,400	63			32,100	327
Trout			50	3			320	18
White bass							400	15
White-fish			30	2				
Yellow perch			34,070	434			100,060	1,453
Total			46,490	737			179,440	3,055
Lines:								
Ling and lawyers					18,300	120		
Yellow perch					31,400	968		
Total					49,700	1,088		
Grand total	491,850	17,778	1,216,940	18,304	193,460	6,561	2,558,255	37,216

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Michigan in 1899—Continued.

Apparatus and species.	Wisconsin—continued.							
	Ozaukee.		Racine.		Sheboygan.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Cat-fish and bullheads							6,180	$198
Herring, fresh	7,010	$110			16,400	$295	2,127,660	23,075
Herring, salted							5,179,100	92,405
Ling or lawyers	1,200	12					1,200	12
Pike and pickerel							19,428	1,110
Pike perch (wall-eyed), fresh							26,635	1,176
Pike perch (wall-eyed), salted							400	22
Sturgeon	250	20			885	64	14,575	728
Suckers, fresh	2,200	24			11,450	136	179,350	1,855
Suckers, salted							17,600	330
Trout, fresh	32,165	1,704			122,615	6,714	354,080	17,668
Trout, salted							10,000	518
White-fish, fresh	3,080	238			2,980	289	14,865	1,073
White-fish (Menominee), fresh							2,050	65
White-fish (Menominee), salted							3,900	140
Yellow perch	650	16			7,250	188	452,300	5,935
Total	46,555	2,124			161,580	7,686	8,409,323	146,310
Gill nets:								
Black bass							560	37
German carp							450	12
Herring, fresh	10,620	194	28,780	$1,062			919,618	14,610
Ling or lawyers							11,000	98
Pike and pickerel							5,600	268
Pike perch (wall-eyed)							1,500	82
Suckers, fresh							29,680	386
Trout, fresh	360	21	12,200	796			670,615	31,796
White-fish, fresh							19,765	1,242
White-fish (bluefin), fresh							170,800	4,330
White-fish (Menominee), fresh							167,815	4,190
White-fish (Menominee), salted							71,300	2,497
Yellow perch	5,800	140	9,600	335			160,195	3,548
Total	16,780	355	50,580	2,193			2,228,898	63,096
Fyke nets:								
Black bass							2,795	207
German carp							11,155	220
Cat-fish and bullheads							55,884	1,481
Herring							71,600	890
Pike and pickerel							41,168	2,110
Pike perch (wall-eyed)							39,502	1,854
Rock bass							4,000	38
Suckers							322,950	2,780
Trout							670	36
White bass							3,600	111
White-fish							30	2
Yellow perch							1,173,899	13,241
Total							1,727,253	22,970
Lines:								
Herring							32,000	400
Ling or lawyers							18,300	120
Trout							125,924	4,881
Pike perch (wall-eyed)							2,250	112
Yellow perch							121,200	2,308
Total							299,674	7,821
Crawfish pots:								
Crawfish							135,861	3,498
Grand total	63,335	2,479	50,580	2,193	161,580	7,686	12,801,609	243,695

Summary showing the total shore fisheries of Lake Michigan in 1899.

Apparatus and species.	Lbs.	Value.
Pound nets:		
Black bass	1,462	$115
German carp	3,525	50
Cat-fish and bullheads	6,278	201
Eels	84	6
Herring, fresh	2,693,325	30,160
Herring, salted	11,322,500	210,847
Ling or lawyers	1,598	22
Pike and pickerel	35,473	1,894
Pike perch (wall-eyed), fresh	89,213	3,775
Pike perch (wall-eyed), salted	400	22
Fresh-water drum	55,372	722
Sturgeon	100,669	6,595
Suckers, fresh	485,303	5,025
Suckers, salted	91,831	1,731
Trout, fresh	661,786	30,413
Trout, salted	19,944	999
White bass	780	35
White-fish, fresh	628,090	30,347
White-fish, salted	53,176	2,881
White-fish (Menominee), fresh	8,185	237
White-fish (Menominee), salted	3,900	140
Yellow perch	598,766	9,063
Total	16,861,660	335,280
Gill nets:		
Black bass	1,974	144
German carp	3,450	72
Herring, fresh	1,288,277	22,976
Herring, salted	13,563	828
Ling or lawyers	33,000	318
Pike and pickerel	7,106	333
Pike perch (wall-eyed)	3,598	181
Rock bass	161	5
Sturgeon	3,176	256
Suckers, fresh	77,934	1,072
Suckers, salted	600	11
Trout, fresh	1,218,546	52,913
Trout, salted	61,893	2,667
White-fish, fresh	222,610	10,480
White-fish, salted	46,601	2,484
White-fish (bluefin), fresh	248,978	6,280
White-fish (bluefin), salted	5,920	276
White-fish (Menominee), fresh	353,985	9,171
White-fish (Menominee), salted	140,130	4,420
Yellow perch	630,759	15,464
Total	4,362,261	130,351
Dip nets:		
German carp	3,150	110
Herring	64,000	1,600
Yellow perch	265,000	9,275
Total	332,150	10,985
Fyke nets:		
Black bass	5,129	$385
German carp	11,155	220
Cat-fish and bullheads	55,884	1,481
Herring	71,600	890
Pike and pickerel	41,568	2,132
Pike perch (wall-eyed)	40,292	1,895
Rock bass	4,000	38
Suckers	323,710	2,790
Trout	670	36
White bass	3,600	111
White-fish	30	2
White-fish (Menominee)	28	2
Yellow perch	1,183,801	13,496
Total	1,741,467	23,478
Seines:		
Herring	1,400	22
Pike and pickerel	2,686	110
Pike perch (wall-eyed)	37,980	1,570
Sturgeon	276	16
Suckers, fresh	9,400	140
Suckers, salted	13,105	131
White-fish	600	31
Yellow perch	1,880	30
Total	67,327	2,050
Lines:		
German carp	4,000	40
Eels	400	34
Herring	32,000	400
Ling or lawyers	25,685	194
Pike and pickerel	600	30
Pike perch (wall-eyed)	2,250	112
Sturgeon	3,905	308
Trout	250,179	10,682
Yellow perch	289,900	7,755
Total	608,919	19,555
Spears:		
Herring	1,100	35
Trout	4,400	220
Yellow perch	1,840	92
Total	7,340	347
Crawfish pots:		
Crawfish	135,861	3,498
Grand total	24,116,985	525,544

WHOLESALE FISHERY TRADE OF CHICAGO AND GREEN BAY.

The wholesale fishery trade on Lake Michigan is most extensive at Chicago, Ill., and Green Bay, Wis. The tendency toward consolidation, which is apparent in the fresh-fish trade of nearly every section of the Great Lakes, has had its effect on these two cities, a certain number of firms in each place combining under one management, which now handles the greater portion of the fresh fish.

Chicago is the most important distributing center for fishery products in the Great Lakes region. In 1899 the number of establishments in the various branches of the wholesale fishery trade of that city was 60. There were 7 firms in the fresh-fish trade, which also handled

oysters and other products, 4 in the oyster trade exclusively, 19 in the salt-fish business, and 30 engaged in preparing and marketing smoked fish. The number of persons employed was 376, and the total investment was $1,839,700. The products embraced fresh fish, 26,850,670 pounds, $1,584,951; salted fish, 27,716,000 pounds, $1,545,374; smoked fish, 4,670,022 pounds, $359,190; and a large quantity of lobsters, shrimp, oysters, and clams, valued at $1,118,189; the total value being $4,607,704. The fresh fish were chiefly from the Great Lakes, the more abundant species being trout, white-fish, lake herring, chubs, yellow perch, suckers, and German carp. The salted and smoked fish, while comprising a number of Great Lakes species, were obtained largely from the Atlantic coast and from various European countries. Among the imported products the principal item was 9,347,000 pounds of salted herring, having a value of $498,578.

The following table shows the extent of the wholesale fishery trade of Chicago, Ill., in 1899:

Products.	Lbs.	Value.	Products.	Lbs.	Value.
Fresh fish:			Salted fish—continued:		
Black bass	304,412	$36,835	Herring, domestic	2,200,000	$59,400
Blue-fish	143,332	11,517	Herring, imported	9,347,000	498,578
Buffalo-fish	333,517	13,668	Lake herring	2,600,000	62,400
Cat-fish and bullheads	168,149	12,357	Mackerel	3,500,000	315,000
Chubs	2,443,506	91,252	Salmon	1,370,000	73,980
Cod	332,706	19,675	Stock-fish	682,000	84,456
Dog-fish	565,875	19,806	Suckers	200,000	4,800
Fresh-water drum	187,130	4,381	Trout	140,000	8,400
German carp	1,077,194	43,143	White-fish	145,000	8,700
Halibut	144,654	13,445			
Herring	497,865	16,753	Total	27,716,000	1,545,374
Lake herring	3,722,902	160,036			
Pike and pickerel	377,233	23,163	Smoked fish:		
Pike perch (blue pike)	64,522	3,028	Chubs	2,138,000	160,120
Pike perch (sauger)	100,862	4,193	Finnan haddie	38,502	2,503
Pike perch (wall-eyed)	1,245,019	116,618	Halibut	420,000	58,800
Red snappers	332,758	23,513	Herring, hard	585,000	9,360
Salmon	410,786	37,812	Herring, bloater	452,200	14,235
Smelt	152,670	9,870	Lake herring	356,000	24,925
Spoonbill cat-fish	167,074	12,531	Salmon	140,000	18,200
Sturgeon	185,410	17,454	Sturgeon	320,000	44,800
Suckers	1,215,550	36,054	Trout	120,000	14,200
Sun-fish	227,092	7,411	Miscellaneous	100,320	12,047
Trout	4,514,371	338,987			
White-fish	3,738,789	330,872	Total	4,670,022	359,190
White-fish (bluefin)	644,046	26,187			
Yellow perch	2,755,580	84,256	Other products:		
Miscellaneous	797,666	70,134	Lobsters	220,356	39,664
			Shrimp.....galls.	8,200	3,345
Total	26,850,670	1,584,951	Oysters, opened ..do...	930,527	1,020,319
			Oysters, in shell .bbls.	5,349	40,338
Salted fish:			Clams, in shell ...do...	3,063	14,523
Anchovies	260,000	13,260			
Cod, boneless	4,880,000	322,080	Total	.....	1,118,189
Cod, dried	2,352,000	90,720			
Eels	40,000	3,600	Total value	.....	4,607,704

At Green Bay 5 firms were engaged in the wholesale fishery trade, and employed 63 persons. The investment, including cash capital, was $73,800. The products aggregated 9,301,517 pounds, valued at $278,986. The greater part of the fish were sold fresh, but large quantities of salted fish and some smoked fish were also utilized in the trade. About 95 per cent of the salted and smoked fish consisted of lake herring, and the remainder of white-fish, trout, and other species.

The extent of the wholesale fishery trade of Green Bay is shown in detail in the following table for the year 1899:

Products.	Lbs.	Value.	Products.	Lbs.	Value.
Black bass	2,813	$254	White-fish (bluefin)	302,446	$13,621
Cat-fish and bullheads	65,519	3,419	Yellow perch	1,302,750	24,976
Herring	1,451,466	29,485	Other fish	54,750	3,039
Pike and pickerel	293,773	19,318	Salted fish	4,151,412	91,501
Suckers	338,314	5,897	Smoked fish	137,742	4,285
Sturgeon	10,518	1,071	Crawfish	7,814	248
Trout	898,098	63,648			
White bass	120,025	5,967	Total products	9,301,517	278,986
White-fish	164,077	12,257			

FISHERIES OF LAKE HURON.

The greatest length of Lake Huron is 250 miles, its greatest width about 100 miles, and it has an area of about 21,000 square miles. The lake is divided into two approximately equal areas by the so-called Big Reef, which extends continuously from Point Clark, Ontario, to North Point, Mich. North of this reef the lake has a maximum depth of 125 fathoms; the southern half of the lake is shallower, the extreme depth being only 54 fathoms.

The number of persons employed in the fisheries of Lake Huron in 1899 was 1,241, of whom 62 were engaged on vessels fishing, 7 on vessels transporting, 986 in the shore or boat fisheries, and 186 were shoresmen employed in various capacities.

The investment in the fisheries of this lake amounted to $474,953. In fishing there were used 9 vessels of a value with their outfits of $50,215, while 3 vessels were employed as transporters and were valued with their outfits at $4,830; 527 boats were in use and were valued at $40,835. The value of the apparatus used in the vessel fisheries was $28,245, and in the shore fisheries $146,939. The shore and accessory property was valued at $148,489, and the cash capital amounted to $55,500.

The products of the fisheries aggregated 12,418,327 pounds, worth $308,078. The most important species in point of value was trout, of which there were taken 1,887,101 pounds, valued at $80,423. Herring amounted to 3,699,807 pounds, worth $60,418; yellow perch, 2,740,669 pounds, worth $32,690; wall-eyed pike, 1,110,516 pounds, worth $49,294; white-fish, 592,308 pounds, worth $31,910; suckers, 1,107,490 pounds, worth $20,320. Other important species were cat-fish and pike.

To the vessel fisheries are credited 1,275,650 pounds of products, valued at $55,535, and to the shore fisheries 11,142,677 pounds, valued at $252,543. The yield of the vessel fisheries was derived almost entirely from gill nets, while in the shore fisheries nearly four-fifths of the catch was taken with pound and trap nets.

While the yield and value of the fisheries of this lake were greater in 1899 than in any previous year for which figures have been obtained, there has been a falling off since 1893 in the catch of trout, white-fish, and some other species. In 1893 29 per cent of the entire catch of the lake was trout, while in 1899 the percentage that this species bore to the entire catch was only 15, showing a falling off of 14 per cent.

Owing to the decided decline in white-fish since 1893 the value of the catch of this species has dropped below that of both wall-eyed pike and perch. The northern half of Lake Huron shows an increase in trout and a decrease in white-fish, while in the southern half the reverse is the case. The deep waters of the northern half of the lake seem to be more favorable to the trout than to the white-fish. The greatest quantities of white-fish are taken in depths of water ranging from 10 to 25 fathoms. The decline in white-fish, mentioned above, shows a decided change in the conditions existing when the fisheries first began on Lake Huron, when this fish was the principal object of capture. It is the opinion generally of the fishermen that, owing to fish-cultural work, the supply of this species is being gradually replenished.

There has been a very noticeable increase in the value of the herring catch as compared with 1893. About 80 per cent of the catch of this species was taken in pound nets set in Saginaw Bay.

The species which show the greatest increase in value since 1893 are the wall-eyed pike, yellow perch, cat-fish and bullheads. The center of abundance of the wall-eyed pike is in Saginaw Bay and River, which yielded 88 per cent of the catch. This species was caught chiefly in pound nets, but large numbers were also speared through the ice on Saginaw River during the winter months.

German carp appeared in the statistics of this lake in 1899 for the first time, none being found there during the previous canvass for 1893. It is probable that this species came from Lake Erie, where it has been very plentiful for several years.

The species in which the greatest decrease has occurred during the past ten years is the sturgeon, the catch in 1899 amounting to only one-twelfth of that taken in 1890. Prior to 1875 this species had no special value, but the price now paid for it is but little lower than that paid for trout. Its present increased value, however, does not compensate to any great extent for the decided falling off in the catch since 1880. Most of the sturgeon are taken in pound nets.

The two least valuable species in the lake are ling or lawyers and fresh-water drum, which until recent years were very seldom saved by the fishermen, owing to their inability to dispose of them. The market value of the fresh-water drum seems to be increasing.

Apparatus.—The most important apparatus of capture used in the fisheries of Lake Huron are pound nets, trap nets, gill nets, fyke nets, and lines, the catch by pound and trap nets representing nearly three-

fourths of the quantity and value of the entire products of the lake. Pound nets are used all along the shores of the lake, but are found in greatest numbers in Saginaw Bay. They are usually set in water from 6 to 25 feet in depth, except off Cheboygan County, where many of them are much farther out in the lake in from 40 to 60 feet of water. Their average value in Saginaw Bay is about $140 each, while for the entire lake it is about $130. In this region the terms "pound net" and "trap net" are sometimes used interchangeably, although the two forms are distinct from each other, the former being set with driven stakes, while the latter is held in position by buoys and anchors. Trap nets are set in shallow water, and catch the cheaper varieties of fish, especially in the vicinity of Detour. In the Saginaw Bay region a net of this character is also called a submarine net, and is used very successfully in taking cat-fish.

The amount of money invested in pound nets in 1899 was more than double that invested in gill nets. The most valuable species taken in pound nets are herring, wall-eyed pike, perch, and white-fish. As a rule the pound-net fishermen, especially at Saginaw Bay, depend upon herring for their principal catch, but in 1899 there was an exceptionally large run of perch and a corresponding diminution in the catch of herring.

The most extensive gill-net fisheries of the lake are carried on from Alpena, Harbor Beach, Au Sable, East Tawas, and Detour, and to a less extent at Rogers City, Cheboygan, and other points. Trout is by far the most important species taken by means of gill nets, its value being more than four times the value of all the other species combined. White-fish also form a very important feature of the gill-net catch. At Harbor Beach an extensive gill-net fishery is carried on for perch, suckers, and Menominee white-fish, the season being from December to July. The nets used have a smaller mesh and are shorter than those used for trout and white-fish. The average length of the gill nets used in the shore fisheries of the lake is about 170 yards, each being valued at about $8, while the average length of those used on vessels is about 230 yards and the value about $12 each. The history of gill nets on Lake Huron dates back to 1835, when crude forms were used in the vicinity of Alpena. They soon gained popularity, and within fifteen years from their introduction were found from the Straits of Mackinac to almost the head of the St. Clair River.

The principal species taken in fyke nets are perch and suckers, but bullheads, pike, and wall-eyed pike are also captured. Most of the fyke-net fishing is carried on in Saginaw River between Saginaw and the mouth of the river. The nets are worth from $15 to $25, and they are fished from late in the fall until early in the spring when the ice begins to leave, practically all of the fishing being done through the ice. The local name given to this net is "gobbler."

Lines are next to fyke nets in the value of their catch, the species taken being chiefly trout, cat-fish, and perch. The most important point at which line fishing is carried on is St. Ignace, where, during the winter, large numbers of the inhabitants are engaged in fishing through the ice for trout. The lines are usually made of linen and soft maitre twine, with one hook, and cost about $1.50 each, the hook alone costing half that amount.

Seines are used in the fisheries of Lake Huron, chiefly at Au Sable and Pine River. The fishing at the former town is done in the Au Sable River near its entrance into the lake; at the latter town the fishing is in the lake itself. Suckers and wall-eyed pike comprise about five-sixths of the fish caught in seines. This apparatus was introduced in Lake Huron in about 1841, but its use has been much less extensive than that of pound nets, gill nets, and fyke nets.

The spear is quite an important apparatus of capture in the Saginaw River, near Bay City, and is used to some extent at other places, principally at Sebewaing and Harbor Beach. Wall-eyed pike and perch form three-fourths of the catch.

Since 1893 there has been a slight decline in the number of steamers fishing gill nets, due no doubt to the falling off in trout and white-fish. The principal points from which steamers fish are Alpena, Harbor Beach, Au Sable, and Saginaw. The catch consists almost exclusively of trout and white-fish, wall-eyed pike being taken incidentally. One steamer fished gill nets of small mesh for Menominee white-fish.

A decrease has taken place in the extent of the fisheries carried on from Port Huron in 1899 as compared with 1893, due to the fact that the wholesale dealers at that town in 1893 furnished twine to fishermen living on the United States side of the lake, while in 1899 this practice had been discontinued and a similar quantity of twine was furnished to Canadian fishermen.

Statistics.—The five tables which follow exhibit by counties the extent of the fisheries of Lake Huron in 1899:

Table showing the number of persons employed in the fisheries of Lake Huron in 1899.

Counties.	On vessels fishing.	On vessels transporting.	In shore or boat fisheries.	Shoresmen.	Total.
Alcona			4		4
Alpena	32	2	25	23	82
Arenac			33		33
Bay		5	346	73	424
Cheboygan			52	7	59
Chippewa	1		40	10	54
Huron	16		218	39	273
Iosco	7		59	4	70
Mackinac			76	3	79
Presque Isle			10	2	12
Saginaw	3		73	8	84
St. Clair			9	16	25
Sanilac			24	1	25
Tuscola			17		17
Total	62	7	986	186	1,241

Table showing, by counties, the apparatus and capital employed in the fisheries of Lake Huron in 1899.

Items.	Alcona.		Alpena.		Arenac.		Bay.		Cheboygan.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing			4	$22,500						
Tonnage			83							
Outfit				4,655						
Vessels transporting			1	250			2	$4,000		
Tonnage			9				90			
Outfit				220				360		
Boats	2	$85	11	630	17	$755	192	12,695	27	$2,400
Apparatus—vessel fisheries:										
Gill nets			1,140	17,100						
Apparatus—shore fisheries:										
Seines			1	50	1	150				
Gill nets	6	42	293	4,121	22	210	23	151	880	6,910
Pound nets and trap nets	2	250	17	1,250	24	3,480	421	50,167	24	3,150
Fyke nets					28	310	154	3,092		
Lines								55		20
Spears							50	100		
Shore and accessory property		15		24,690		1,875		60,780		5,575
Cash capital								25,000		2,500
Total		392		75,466		6,780		156,400		20,555

Items.	Chippewa.		Huron.		Iosco.		Mackinac.		Presque Isle.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	1	$2,500	2	$7,000	1	$7,000				
Tonnage	14		29		24					
Outfit		20		1,285		1,170				
Boats	35	3,010	112	11,920	24	2,280	27	$3,300	6	$360
Apparatus—vessel fisheries:										
Gill nets			616	5,580	270	3,240				
Trap nets	35	525								
Apparatus—shore fisheries:										
Seines					6	423				
Gill nets	273	2,359	555	3,194	621	4,650	371	2,267	60	600
Pound nets and trap nets	134	5,660	179	30,080	46	4,845	21	3,755	6	192
Fyke nets	30	180	61	900	3	75				
Lines		50		90				86		
Spears			55	110						
Shore and accessory property		6,965		14,175		3,490		550		750
Cash capital		2,500		500						
Total		23,769		74,834		27,173		9,958		1,902

Items.	Saginaw.		St. Clair.		Sanilac.		Tuscola.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	1	$3,500							9	$42,500
Tonnage	7								157	
Outfit		585								7,715
Vessels transporting									3	4,250
Tonnage									99	
Outfit										580
Boats	41	960	5	$505	16	$1,180	12	$755	527	40,835
Apparatus—vessel fisheries:										
Gill nets	240	1,800							2,266	27,720
Trap nets									35	525
Apparatus—shore fisheries:										
Seines	1	50							9	673
Gill nets	80	600	30	240	196	1,320			3,410	26,664
Pound nets and trap nets	31	1,760	8	1,450	14	2,625	34	2,650	961	111,314
Fyke nets	98	2,685					24	390	398	7,632
Lines		45								346
Spears									105	210
Shore and accessory property		8,019		16,885		4,720		450		148,489
Cash capital		2,000		23,000						55,500
Total		22,004		42,080		9,395		4,245		474,953

Table showing, by counties, the products of the fisheries of Lake Huron in 1899.

Species.	Alcona.		Alpena.		Arenac.		Bay.		Cheboygan.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Black bass			4,119	$285					75	$5
Cat-fish and bullheads					13,101	$366	363,142	$9,829		
German carp					200	1	1,310	15		
Eels							634	35		
Fresh-water drum, fresh					3,177	16	97,237	516		
Herring, fresh	700	$35	10,600	130	8,607	113	332,021	2,448	4,500	65
Herring, salted	750	25	38,450	782	155,870	2,147	547,910	9,388	27,600	436
Pike and pickerel, fresh					10,854	449	71,799	3,130	200	5
Pike perch (wall-eyed), fresh	950	66	28,305	1,556	28,674	1,041	543,055	20,958	6,350	347
Pike perch (wall-eyed), salted							2,970	102		
Rock bass					4,674	64	41,277	864	50	1
Sturgeon	167	8	8,367	291	225	8	2,147	65	2,885	95
Suckers, fresh			3,500	47	24,467	331	498,176	8,316		
Suckers, salted			12,500	250	990	17	7,040	135	7,350	91
Sun-fish							24,389	350		
Trout, fresh	50	4	738,495	34,743	550	31	2,908	146	65,498	2,655
Trout, salted							770	29		
White-fish, fresh			73,524	3,816	21,339	1,036	185,769	11,013	22,600	1,259
White-fish, salted					770	28	4,620	208		
White-fish (Menominee), fresh	650	50	1,100	82	2,752	78	512	11		
White-fish (Menominee), salted							5,830	237	2,000	40
Yellow perch, fresh	170	13	10,450	273	42,597	534	1,947,397	20,662	1,880	34
Frogs							8,000	520		
Total	3,437	201	929,410	42,255	318,847	6,260	4,688,913	88,977	140,988	5,033

Species.	Chippewa.		Huron.		Iosco.		Mackinac.		Presque Isle.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Black bass			500	$30			865	$69	100	$7
Cat-fish and bullheads	32,811	$710	64,402	2,548	5,821	$108				
German carp			438	10	1,000	10				
Eels			65	5	71	4				
Fresh-water drum, fresh			42,080	331	3,416	16				
Fresh-water drum, salted			2,420	47						
Herring, fresh			474,977	4,844	403	3	35,000	350		
Herring, salted	38,500	673	1,190,290	24,234	395,770	7,809	8,000	160		
Herring, smoked			2,700	90						
Ling or lawyers	880	17								
Pike and pickerel, fresh	70,788	1,533	745	38	387	14				
Pike perch (wall-eyed), fresh	66,300	3,149	319,023	16,983	16,957	769			1,560	97
Pike perch (wall-eyed), salted					330	16				
Rock bass	6,000	44	300	4						
Sturgeon	1,725	58	5,729	202	4,087	140	160	5		
Suckers, fresh	58,370	206	84,890	1,359	60,443	1,112			600	3
Suckers, salted	51,355	654	13,750	220	30,710	423	2,500	25	600	3
Sun-fish	6,600	47	115	2	72	1				
Trout, fresh	164,690	6,237	257,145	9,994	283,405	11,425	156,620	6,916	53,000	1,605
Trout, salted	1,800	90			220	12	4,400	195		
White-fish, fresh	37,070	1,838	67,275	4,153	98,620	4,101	33,020	1,615		
White-fish, salted			1,650	93	1,100	56				
White-fish (Menominee), fresh			67,730	1,344	1,378	34	2,900	64		
White-fish (Menominee), salted					1,330	59	14,900	474		
Yellow perch, fresh	25,940	213	440,348	7,097	66,946	853	2,333	103		
Yellow perch, salted							500	10		
Total	562,829	15,469	3,036,572	73,628	972,466	26,965	261,198	9,986	55,800	1,715

Table showing, by counties, the products of the fisheries of Lake Huron in 1899—Cont'd.

Species.	Saginaw.		St. Clair.		Sanilac.		Tuscola.		Total.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Black bass									5,659	$896
Cat-fish and bullheads	46,090	$1,759	140	$7			48,899	$1,300	574,406	16,627
German carp	2,900	98	300	7			221	2	6,369	145
Eels	50	2					41	3	861	49
Fresh-water drum, fresh	170	2	4,000	40	8,000	$40	146	1	158,226	962
Fresh-water drum, salted									2,420	47
Herring, fresh			109,730	1,214	92,000	1,460	5,419	34	1,073,957	10,696
Herring, salted			30,000	527	184,400	3,340	5,610	111	2,623,150	49,632
Herring, smoked									2,700	90
Ling or lawyers	20,000	150							20,880	167
Pike and pickerel, fresh	34,644	1,750	100	5			2,278	83	191,795	7,007
Pike and pickerel, salted							440	9	440	9
Pike perch (wall-eyed), fresh	19,930	1,294	26,715	1,077	13,400	559	35,947	1,276	1,107,106	49,172
Pike perch (wall-eyed), salted							110	4	3,410	122
Rock bass	30,750	632					293	3	83,344	1,612
Sturgeon			2,855	120	*2,150	276			30,497	1,268
Suckers, fresh	240,855	7,065	800	5			8,594	58	980,695	18,502
Suckers, salted									126,795	1,818
Sun-fish	29,750	338					136	1	61,062	739
Trout, fresh	117,335	4,940	260	12	39,455	1,369			1,879,411	80,077
Trout, salted					500	20			7,690	346
White-fish, fresh	27,500	1,750	2,355	102	6,250	298	8,846	544	584,168	31,525
White-fish, salted									8,140	385
White-fish (Menominee), fresh			350	13	35,045	991			112,417	2,667
White-fish (Menominee), salted									24,060	810
Yellow perch, fresh	120,986	1,819	550	8	13,500	366	67,072	675	2,740,169	32,680
Yellow perch, salted									500	10
Frogs									8,000	520
Total	690,960	21,629	178,155	3,137	394,700	8,719	184,052	4,104	12,418,327	308,078

*Includes 300 pounds of caviar, valued at $195, being a part of the product of the pound-net fishery of Sanilac County.

Table showing, by counties and apparatus, the products of the vessel fisheries of Lake Huron in 1899.

Apparatus and species.	Alpena.		Huron.		Iosco.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:						
Trout	673,270	$31,292	185,000	$7,295	161,760	$6,673
Pike perch (wall-eyed)			1,000	55	3,000	165
White-fish	46,020	2,375	2,500	110	5,000	220
White-fish (Menominee)			46,000	690		
Total	719,290	33,667	234,500	8,150	118,500	5,670

Apparatus and species.	Chippewa.		Saginaw.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:						
Trout			96,000	$4,140	1,116,030	$49,400
Pike perch (wall-eyed)					4,000	220
White-fish			22,500	1,530	76,020	4,235
White-fish (Menominee)					46,000	690
Total			118,500	5,670	1,242,050	54,545
Trap nets:						
Cat-fish and bullheads	1,800	$40			1,800	40
Pike and pickerel	8,500	170			8,500	170
Pike perch (wall-eyed)	4,300	150			4,300	150
Trout	15,000	600			15,000	600
Yellow perch	4,000	30			4,000	30
Total	33,600	990			33,600	990
Grand total	33,600	990	118,500	5,670	1,275,650	55,535

Table showing, by counties and apparatus, the products of the shore fisheries of Lake Huron in 1899.

Apparatus and species.	Alcona.		Alpena.		Arenac.		Bay.		Saginaw.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Pound and trap nets:										
Black bass			4,119	$285						
Cat-fish and bullheads					3,854	$100	324,220	$8,535	14,445	$562
German carp					200	1	994	11	1,595	54
Eels							467	26	30	1
Fresh-water drum, fresh					3,177	16	96,835	513	90	1
Herring, fresh	200	$10	10,100	105	7,587	98	328,114	2,417		
Herring, salted			37,700	757	154,440	2,120	545,160	9,328		
Ling, or lawyers									12,000	90
Pike and pickerel, fresh					1,320	54	61,140	2,611	18,820	938
Pike perch (wall-eyed), fresh	800	56	26,222	1,451	14,338	653	486,548	17,297	10,835	713
Pike perch (wall-eyed), salted							2,970	102		
Rock bass					92	1	29,333	645	16,720	330
Sturgeon	167	8	8,367	291	225	8	2,022	59		
Suckers, fresh					7,013	108	422,150	6,529	129,470	3,795
Suckers, salted			7,500	150	330	5	6,600	129		
Sun-fish							16,467	210	15,870	170
Trout, fresh					550	31	2,908	146		
Trout, salted							770	29		
White-fish, fresh			12,789	662	21,157	1,025	185,737	11,011		
White-fish, salted					770	28	4,620	208		
White-fish (Menominee), fresh			400	32	2,676	75	512	11		
White-fish (Menominee), salted							5,830	237		
Yellow perch	100	8	10,150	262	29,031	367	1,623,236	17,126	65,120	990
Total	1,267	82	117,347	3,995	246,760	4,690	4,146,633	77,180	284,995	7,644
Gill nets:										
Cat-fish and bullheads					725	20				
Herring, fresh	500	25	500	25			2,140	15		
Herring, salted	750	25	750	25						
Pike and pickerel					7,500	305	74	4		
Pike perch (wall-eyed)	150	10	283	15	60	4	129	6		
Rock bass					500	6				
Suckers, fresh			3,500	47			488	17		
Suckers, salted					440	8	440	6		
Trout, fresh	50	4	65,225	3,451					21,335	800
White-fish			14,715	779	132	8			5,000	220
Yellow perch	70	5	100	6	500	7	1,000	8		
White-fish (Menominee), fresh	650	50	700	50						
Total	2,170	119	85,773	4,398	9,857	358	4,271	56	26,335	1,020
Fyke nets:										
Cat-fish and bullheads					7,840	231	29,800	1,035	11,735	450
Fresh-water drum							402	3	80	1
German carp							316	4	1,305	44
Eels							167	9	20	1
Herring, fresh					1,020	15	1,767	16		
Herring, salted					1,320	25	2,750	60		
Ling or lawyers									8,000	60
Pike and pickerel					1,865	84	10,585	515	15,424	792
Pike perch (wall-eyed)					783	45	10,093	495	8,895	568
Rock bass					4,082	57	11,944	219	13,680	295
Sturgeon							125	6		
Suckers, fresh					12,007	185	75,538	1,770	105,885	3,105
Suckers, salted					220	4				
Sun-fish							7,922	140	13,530	164
White-fish					50	3	32	2		
White-fish (Menominee)					76	2				
Yellow perch					11,242	146	321,661	3,498	53,266	823
Total					40,505	798	473,102	7,772	231,820	6,303
Seines:										
Cat-fish and bullheads					682	15			910	37
Herring, salted					110	2				
Pike and pickerel					169	6			400	20
Rock bass									350	7
Suckers, fresh					5,447	38			5,500	165
Suckers, salted			5,000	100						
Sun-fish									350	4
Pike perch (wall-eyed)			1,800	90	13,493	339			200	13
Yellow perch			200	5	1,824	14			2,600	36
Total			7,000	195	21,725	414			10,310	282

Table showing, by counties and apparatus, the products of the shore fisheries of Lake Huron in 1899—Continued.

Apparatus and species.	Alcona.		Alpena.		Arenac.		Bay.		Saginaw.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Lines:										
Cat-fish and bullheads							9,122	$259	19,000	$710
Miscellaneous apparatus:										
Pike perch (wall-eyed)							46,285	3,160		
Frogs							8,000	520		
Yellow perch							1,500	30		
Total							55,785	3,710		
Grand total	3,437	$201	210,120	$8,588	318,847	$6,260	4,688,915	88,977	572,460	15,959

Apparatus and species.	Mackinac.		Presque Isle.		St. Clair.		Sanilac.		Tuscola.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound and trap nets:										
Black bass	100	$8	100	$7						
Cat-fish and bullheads					140	$7			45,605	$1,228
German carp					300	7				
Eels									25	2
Fresh-water drum					4,000	40	8,000	$40	146	1
Herring, fresh	35,000	350			109,730	1,214	92,000	1,460	5,419	34
Herring, salted	8,000	160			30,000	527	184,400	3,340	5,610	111
Pike and pickerel, fresh					100	5			2,253	82
Pike and pickerel, salted									440	9
Pike perch (wall-eyed), fresh			1,500	97	22,515	909	13,400	559	35,747	1,266
Pike perch (wall-eyed), salted									110	4
Rock bass									193	2
Sturgeon					2,855	120	2,150	276		
Suckers, fresh			600	3	800	5			7,003	46
Suckers, salted	2,500	25	600	3						
Sun-fish									136	1
Trout, fresh	4,900	160			260	12	13,190	485		
White-fish, fresh	16,400	940			2,355	102	6,250	298	8,846	544
White-fish (Menominee), fresh					350	13	295	6		
Yellow perch	200	2			550	8	7,000	230	60,000	603
Total	67,100	1,645	2,800	110	173,955	2,969	326,685	6,694	171,533	3,933
Gill nets:										
Black bass	765	61								
Sturgeon	160	5								
Trout, fresh	63,920	2,028	53,000	1,605			26,265	884		
Trout, salted	4,400	195					500	20		
Pike perch (wall-eyed)					4,200	168				
White-fish	16,620	675								
White-fish (Menominee), fresh	1,500	30					34,750	985		
White-fish (Menominee), salted	14,900	474								
Yellow perch	133	1					6,500	136		
Total	102,398	3,469	53,000	1,605	4,200	168	68,015	2,025		
Fyke nets:										
Cat-fish and bullheads									3,294	72
German carp									221	2
Eels									16	1
Pike and pickerel									25	1
Pike perch (wall-eyed)									200	10
Rock bass									100	1
Suckers, fresh									1,591	12
Yellow perch									7,072	72
Total									12,519	171
Lines:										
Trout	87,800	4,728								
White-fish (Menominee)	1,400	34								
Yellow perch, fresh	2,000	100								
Yellow perch, salted	500	10								
Total	91,700	4,872								
Grand total	261,198	9,986	55,800	1,715	178,155	3,137	394,700	8,719	184,052	4,104

Table showing, by counties and apparatus, the products of the shore fisheries of Lake Huron in 1899—Continued.

Apparatus and species.	Cheboygan.		Chippewa.		Huron.		Iosco.	
	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound and trap nets:								
Black bass	75	$5						
Cat-fish and bullheads			23,061	$495	54,258	$2,320	5,821	$108
German carp					438	10	1,000	10
Eels					65	5	71	4
Fresh-water drum, fresh					42,080	331	3,416	16
Fresh-water drum, salted					2,420	47		
Herring, fresh	4,500	65			464,727	4,664	403	3
Herring, salted	27,000	430	38,500	673	1,190,290	24,234	392,030	7,732
Herring, smoked					2,700	90		
Ling or lawyers			880	17				
Pike and pickerel, fresh	200	5	56,288	1,183	184	10	229	10
Pike perch (wall-eyed), fresh	6,350	347	61,000	2,962	303,066	16,138	6,368	239
Pike perch (wall-eyed), salted							330	16
Rock bass	50	1	6,000	44	300	4		
Sturgeon	1,035	35	1,725	58	5,729	202	4,087	140
Suckers, fresh			58,370	206	28,050	353	24,058	191
Suckers, salted	6,500	82	46,355	604	13,750	220	30,710	423
Sun-fish			6,600	47	115	2	72	1
Trout, fresh	34,076	1,409	53,215	1,926	945	49	27,610	994
Trout, salted							220	12
White-fish, fresh	22,000	1,229	35,960	1,772	62,275	3,943	67,875	2,808
White-fish, salted					1,650	93	1,100	56
White-fish (Menominee), fresh					430	15	1,378	34
White-fish (Menominee), salted	2,000	40					1,330	59
Yellow perch	1,800	33	19,940	163	251,362	4,284	65,272	829
Total	105,586	3,681	407,894	10,150	2,424,834	57,014	633,380	13,685
Gill nets:								
Herring, fresh					4,000	55		
Herring, salted	600	6					3,300	68
Pike and pickerel					100	6		
Pike perch (wall-eyed)					9,294	480	6,976	328
Suckers, fresh					44,740	893	1,600	16
Suckers, salted	850	9						
Trout, fresh	31,422	1,246	89,475	3,501	61,200	2,200	94,035	3,758
Trout, salted			1,800	90				
White-fish	600	30	1,110	66	2,500	100	25,335	1,053
White-fish (Menominee), fresh					21,300	639		
Yellow perch	80	1			116,405	1,744	47	1
Total	33,552	1,292	92,385	3,657	259,539	6,117	131,293	5,224
Fyke nets:								
Cat-fish and bullheads			7,950	175	7,480	173		
Pike and pickerel			6,000	180	105	4		
Pike perch (wall-eyed)			1,000	37	2,100	91		
Suckers, fresh					12,100	113	300	4
Suckers, salted			5,000	50				
Yellow perch			2,000	20	39,100	458	1,500	20
Total			21,950	462	60,885	839	1,800	24
Seines:								
Herring, salted							110	9
Pike and pickerel							158	4
Pike perch (wall-eyed)							613	37
Suckers, fresh							34,485	901
White-fish							410	20
Yellow perch							127	3
Total							36,233	974
Lines:								
Cat-fish and bullheads					2,664	55		
Sturgeon	1,850	60						
Trout			7,000	210	10,000	450		
Yellow perch, fresh					9,863	139		
Total	1,850	60	7,000	210	22,527	644		
Miscellaneous apparatus:								
Black bass					500	30		
Herring					6,250	125		
Pike and pickerel					356	18		
Pike perch (wall-eyed)					3,563	219		
Yellow perch					23,618	472		
Total					34,287	864		
Grand total	140,988	5,033	529,229	14,479	2,802,072	65,478	802,706	19,907

Summary of the products of the shore fisheries of Lake Huron in 1899.

Apparatus and species.	Lbs.	Value.
Pound nets and trap nets:		
Black bass	4,394	$305
Cat-fish and bullheads	471,404	13,355
Eels	658	38
Fresh-water drum, fresh	157,744	958
Fresh-water drum, salted	2,420	47
German carp	4,527	93
Herring, fresh	1,057,780	10,420
Herring, salted	2,613,130	49,412
Herring, smoked	2,700	90
Ling or lawyers	12,880	107
Pike and pickerel, fresh	140,534	4,898
Pike and pickerel, salted	440	9
Pike perch (wall-eyed), fresh	988,689	42,687
Pike perch (wall-eyed), salted	3,410	122
Rock bass	52,688	1,027
Sturgeon	28,362	1,197
Suckers, fresh	677,514	11,236
Suckers, salted	114,845	1,641
Sun-fish	39,260	431
Trout, fresh	137,654	5,212
Trout, salted	990	41
White-fish, fresh	411,644	24,334
White-fish, salted	8,140	385
White-fish (Menominee), fresh	6,041	186
White-fish (Menominee), salted	9,160	336
Yellow perch	2,133,761	24,905
Total	9,110,769	193,472
Gill nets:		
Black bass	765	61
Cat-fish and bullheads	725	20
Herring, fresh	7,140	120
Herring, salted	5,400	124
Pike and pickerel	7,674	315
Pike perch (wall-eyed)	21,092	1,011
Rock bass	500	6
Sturgeon	160	5
Suckers, fresh	50,328	973
Suckers, salted	1,730	23
Trout, fresh	505,927	19,477
Trout, salted	6,700	305
White-fish	66,012	2,931
White-fish (Menominee), fresh	58,900	1,754
White-fish (Menominee), salted	14,900	474
Yellow perch	124,835	1,909
Total	872,788	29,508
Fyke nets:		
Cat-fish and bullheads	68,099	$2,136
Eels	203	11
Fresh-water drum	482	4
German carp	1,842	50
Herring, fresh	2,787	31
Herring, salted	4,070	85
Ling or lawyers	8,000	60
Pike and pickerel	34,004	1,576
Pike perch (wall-eyed)	23,071	1,246
Rock bass	29,806	572
Sturgeon	125	6
Suckers	207,421	5,189
Suckers, salted	5,220	54
Sun-fish	21,452	304
White-fish	82	5
White-fish (Menominee)	76	3
Yellow perch	435,841	5,037
Total	842,581	16,396
Seines:		
Cat-fish and bullheads	1,592	52
Herring, salted	550	11
Pike and pickerel	727	30
Pike perch (wall-eyed)	16,106	479
Rock bass	350	7
Suckers, fresh	45,432	1,104
Suckers, salted	5,000	100
Sun-fish	350	4
White-fish	410	20
Yellow perch	4,751	58
Total	75,268	1,865
Lines:		
Cat-fish and bullheads	30,786	1,024
Sturgeon	1,850	60
Trout	104,800	5,388
White-fish (Menominee)	1,400	34
Yellow perch, fresh	11,863	239
Yellow perch, salted	500	10
Total	151,199	6,755
Miscellaneous apparatus:		
Black bass	500	30
Frogs	8,000	520
Herring	6,250	125
Pike and pickerel	356	18
Pike perch (wall-eyed)	49,848	3,379
Yellow perch	25,118	502
Total	90,072	4,574
Grand total	11,142,677	252,543

WHOLESALE FISHERY TRADE OF LAKE HURON.

In 1899 there were 13 establishments engaged in the wholesale fishery trade of Lake Huron. The persons employed numbered 87; the wages paid amounted to $23,314; the cash capital was $55,500, and the value of the establishments, with their apparatus, etc., was $57,295. This business is centered principally at West Bay City, Essexville, and Port Huron, but is carried on to some extent at Detour, Mackinaw City, Sebewaing, and Saginaw. The firms at West Bay City and Essexville handle most of the fish taken in the Saginaw Bay region, except those taken at Bay Port and on the Saginaw River above Bay City. The greater part of the fish, fresh and salted, caught in these two localities is shipped by the fishermen to different sections of the country. The fish handled by the wholesale dealers are caught chiefly by fishermen living on the American side of the lake, but large quantities of Canadian fish are also utilized in the trade.

The following table shows the extent of the wholesale trade in fishery products in all localities on Lake Huron for the year 1899:

Products sold.	Lbs.	Value.	Products sold.	Lbs.	Value.
Black bass	804	$72	Salt-water fish	27,721	$1,697
Cat-fish and bullheads	321,910	21,838	Sturgeon	95,394	22,011
Eels	562	40	Suckers, fresh	573,757	15,103
Fresh-water drum, fresh	236,721	2,079	Suckers, salted	198,912	3,257
Fresh-water drum, salted	1,430	28	Sun-fish	19,707	292
German carp	1,456	36	Trout, fresh	799,917	52,241
Herring, fresh	775,962	13,401	Trout, salted	3,410	196
Herring, salted	1,706,653	34,122	White-fish, fresh	599,571	45,695
Herring, smoked	22,060	920	White-fish, salted	9,460	525
Ling or lawyers	792	19	White-fish (Menominee), fresh	6,952	304
Pike and pickerel, fresh	181,617	8,791	White-fish (Menominee), salted	125,452	4,445
Pike and pickerel, salted	440	11	Yellow perch, fresh	2,336,134	44,070
Pike perch (wall-eyed), fresh	1,180,170	65,268	Yellow perch, salted	6,600	150
Pike perch (wall-eyed), salted	3,410	133	Total	9,299,806	338,282
Rock bass	62,832	1,538			

NOTE.—Included in the above is 636,865 pounds of fish imported from Canada, valued at $40,922. Of this quantity sturgeon comprised 65,190 pounds and caviar 22,060 pounds, the combined value of which was $21,474.

FISHERIES OF LAKE ST. CLAIR, ST. CLAIR AND DETROIT RIVERS.

The fisheries of Lake St. Clair and tributaries in 1899 gave employment to 442 persons, of whom 374 were engaged in the shore fisheries and 68 on shore in fish-houses. The total amount of capital invested was $54,535. The number of boats in use was 188, valued at $3,770. The apparatus of capture was valued at $3,820, the greater part of which represented the value of seines and pound nets. The shore and accessory property was valued at $26,945, while the cash capital employed amounted to $20,000.

The total yield of the fisheries was 579,067 pounds of products, valued at $23,864. Wall-eyed pike is the most important species in these fisheries, the catch being 268,350 pounds, worth $11,877. Among other important species were trout, 69,915 pounds, worth $2,884; pike and pickerel, 42,715 pounds, valued at $1,821; perch, 40,000 pounds, valued at $1,202; sturgeon, 7,600 pounds, valued at $1,352, and white-fish, 69,902 pounds, valued at $3,087.

Nearly half of the catch, or 256,425 pounds, valued at $10,464, was made with lines. Seines are next in importance in these waters, the yield being 184,402 pounds, worth $7,678. The catch by gill nets and pound nets was much smaller, being valued at $2,958 for the former and $502 for the latter.

Owing to restrictions placed upon the fisheries of this region, especially in Lake St. Clair, the results of the present canvass show a very decided falling off as compared with the returns for 1893. In that year there were in use 380 gill nets, 91 pound nets, 60 fyke nets, and 20 seines, while in 1899 there were only 60 gill nets, 5 pound nets, and 13 seines, fyke nets being no longer in use.

The most valuable species taken are wall-eyed pike, white-fish, trout, pike, sturgeon, and yellow perch. The value of the catch of wall-eyed pike is about equal to that of all the other species combined. They are taken mostly on lines and in seines, two-thirds of the quantity being caught with lines on the St. Clair River. The line catch is divided between those who follow "chugging" and those fishing with trolling lines. In "chugging" a short line is used, this being continually jerked up and down to attract the attention of the fish. This is followed by both white men and Indians, very few of the latter, however, fishing from the United States side of the river.

White-fish are second in the value of the catch, and are taken mostly in the Detroit River by means of seines. An arrangement was made with a fishing firm at Detroit whereby the latter furnished the men, apparatus, and boats in return for the white-fish after they had been stripped of eggs by employees of the Commission.

Nearly all of the pike were taken by means of spears through the ice on the St. Clair River. Perch were taken mostly on hand lines.

Following are the statistical tables showing by counties the extent of the fisheries of Lake St. Clair and the St. Clair and Detroit rivers in 1899:

Table showing, by counties, the number of persons employed in the fisheries of Lake St. Clair and the St. Clair and Detroit rivers in 1899.

Counties.	In shore fisheries.	On shore, in fish houses, etc.	Total.
Macomb	5	.....	5
St. Clair	297	8	305
Wayne	72	60	132
Total	374	68	442

Table showing, by counties, the apparatus and capital employed in the fisheries of Lake St. Clair and the St. Clair and Detroit rivers in 1899.

Items.	Macomb.		St. Clair.		Wayne.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	5	$50	171	$2,165	12	$1,555	188	$3,770
Apparatus—shore fisheries:								
Seines	.....	.....	5	575	8	680	13	1,255
Gill nets	.....	.....	.....	.....	60	600	60	600
Pound nets	.....	.....	.....	.....	5	1,050	5	1,050
Lines	.....	22	.....	610	.....	12	.....	644
Other apparatus	.....	.....	.....	270	.....	1	.....	271
Shore and accessory property	.....	10	.....	1,750	.....	25,185	.....	26,945
Cash capital	.....	.....	.....	.....	.....	20,000	.....	20,000
Total	.....	82	.....	5,370	.....	49,083	.....	54,535

Table showing, by counties, the yield of the fisheries of Lake St. Clair and the St. Clair and Detroit rivers in 1899.

Species.	Macomb.		St. Clair.		Wayne.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass			200	$14			200	$14
Cat-fish and bullheads	13,000	$475	1,700	35	2,805	$119	17,505	629
Fresh-water drum			12,050	61	5,000	70	17,050	131
German carp			3,500	18	4,500	203	8,000	221
Minnows					280	100	280	100
Pike and pickerel			42,250	1,783	465	38	42,715	1,821
Pike perch (wall-eyed)			265,150	11,688	3,200	189	268,350	11,877
Rock bass			2,100	62	1,600	155	3,700	217
Sturgeon			3,200	972	4,400	380	7,600	1,352
Suckers			25,000	125	8,600	200	33,600	325
Sun-fish			200	2	50	2	250	4
Trout					69,915	2,884	69,915	2,884
White-fish					69,902	3,087	69,902	3,087
Yellow perch			38,000	990	2,000	212	40,000	1,202
Total	13,000	475	393,350	15,750	172,717	7,639	579,067	23,864

Table showing, by counties and apparatus of capture, the yield of the fisheries of Lake St. Clair and the St. Clair and Detroit rivers in 1899.

Apparatus and species.	Macomb.		St. Clair.		Wayne.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Cat-fish and bullheads					230	$9	230	$9
Fresh-water drum					4,000	20	4,000	20
German carp					500	3	500	3
Suckers					6,000	30	6,000	30
Sturgeon					4,400	380	4,400	380
Pike and pickerel					90	4	90	4
Pike perch (wall-eyed)					900	44	900	44
Yellow perch					400	12	400	12
Total					16,520	502	16,520	502
Gill nets:								
Trout					69,915	2,884	69,915	2,884
White-fish					1,675	74	1,675	74
Total					71,590	2,958	71,590	2,958
Seines:								
Fresh-water drum			12,000	$60	1,000	50	13,000	110
German carp			3,500	18	4,000	200	7,500	218
Pike and pickerel			400	12	375	34	775	46
Rock bass					1,600	155	1,600	155
Sturgeon			3,200	972			3,200	972
Suckers			25,000	125	2,600	170	27,600	295
Sun-fish					50	2	50	2
Pike perch (wall-eyed)			58,550	2,522	2,300	145	60,850	2,667
White-fish					68,227	3,013	68,227	3,013
Yellow perch					1,600	200	1,600	200
Total			102,650	3,709	81,752	3,969	184,402	7,678
Lines:								
Fresh-water drum			50	1			50	1
Black bass			200	14			200	14
Cat-fish and bullheads	13,000	$475	1,700	35	2,575	110	17,275	620
Pike and pickerel			600	25			600	25
Rock bass			2,100	62			2,100	62
Sun-fish			200	2			200	2
Pike perch (wall-eyed)			201,000	8,825			201,000	8,825
Yellow perch			35,000	915			35,000	915
Total	13,000	475	240,850	9,879	2,575	110	256,425	10,464
Miscellaneous apparatus:								
Minnows					280	100	280	100
Pike and pickerel			41,250	1,746			41,250	1,746
Pike perch (wall-eyed)			5,600	341			5,600	341
Yellow perch			3,000	75			3,000	75
Total			49,850	2,162	280	100	50,130	2,262
Grand total	13,000	475	393,350	15,750	172,717	7,639	579,067	23,864

The trout shown in the foregoing products tables were taken in Lake Huron by a steam tug owned at Detroit, which at the same time took 1,675 pounds of white-fish. The catch of the tug has been credited, for the sake of comparison, to this region to conform with the practice followed in 1893.

FISHERIES OF LAKE ERIE.

The total number of persons employed in the fisheries of Lake Erie in 1899 was 3,728. Of this number 574 were engaged on vessels fishing, 65 on vessels transporting, 2,401 in the shore or boat fisheries, and 688 were shoresmen. The number of persons credited to the different States bordering on this lake is as follows: New York, 976; Pennsylvania, 464; Ohio, 2,168, and Michigan, 120. The total investment in the fisheries was $2,720,554. There were 85 vessels engaged in fishing, which were valued with their outfits at $352,281. There were also 19 transporting vessels, having a value with their outfits of $87,696; the number of boats, including steamboats and launches under 5 net tons, was 876, valued at $79,466. The gill nets employed in the vessel fisheries numbered 29,018, and were valued at $160,870. The total value of the apparatus employed in the shore fisheries was $425,564, which sum includes $313,125, representing the value of 1,298 pound nets. Shore and accessory property was valued at $1,050,977, and the cash capital employed amounted to $563,700. By far the greater part of the investment is credited to Ohio, the amount being $1,872,522. Pennsylvania ranks next in the importance of its fisheries, the investment being $456,102, followed by New York with an investment of $321,393 and Michigan with $70,537.

The fisheries yielded 58,393,864 pounds of products, valued at $1,150,895. Herring is the principal species represented in the fisheries of this lake, both in respect to quantity and value, the yield being 33,427,797 pounds, valued at $431,037. White-fish amounted to 2,066,314 pounds, valued at $152,009; blue pike, 4,544,786 pounds, valued at $139,301, while other species yielded in important quantities were yellow perch, valued at $52,625; saugers, valued at $75,313; sturgeon, valued at $53,392; wall-eyed pike, valued at $86,455, and carp, at $51,456. The value of the yield of the fisheries in Lake Erie is divided among the different States as follows: Ohio, $677,305; Pennsylvania, $275,887; New York, $140,919, and Michigan, $56,784.

The fisheries of Lake Erie are nearly equal in extent to those of all the other Great Lakes combined. Owing to the shallowness of this lake it is especially adapted to the prosecution of the pound-net fisheries. The gradual development of the gill-net fishery with steam vessels has resulted in the extension of fishery operations to all parts of the lake. In 1899 the yield was nearly as great as in 1890, but there was a great decrease as compared with that year in the quantity of apparatus employed and in the amount of capital invested. In 1890, 34 steam vessels fished 19,046 gill nets, while in 1899, 85 vessels fished 29,018 gill nets. As the number of gill nets in the vessel fisheries increases, the number used in the shore fisheries decreases. In

1890, 30,274 gill nets were operated in the shore fisheries, while in 1899 only 12,660 were employed. As a result of this change the catch made by vessels is much more important than that by boats. In 1890 the quantity of fish taken with gill nets by vessels was 14,079,281 pounds and by boats 14,769,072 pounds, while in 1899 the vessel gill-net catch had increased to 32,166,659 pounds and the boat gill-net catch had decreased to 6,495,514 pounds.

As compared with 1893 there has been an increase in the products of the fisheries of this lake of 15,425,539 pounds in quantity and of $344,916 in value. This increase obtained chiefly in the yield of herring and white-fish.

As has been already stated, gill nets only are used in the vessel fisheries; herring is the most important species secured, the catch being 27,170,534 pounds, worth $347,017. Yellow perch, blue pike, and white-fish are also taken in large quantities.

In the shore fisheries pound nets yielded 11,470,675 pounds of products, valued at $314,763; gill nets, 6,495,514 pounds, valued at $146,480; seines, 3,417,818 pounds, worth $50,690; trap nets, 2,007,105 pounds, worth $42,881; fyke nets, 1,356,744 pounds, worth $27,582; and lines, 1,409,944 pounds, worth $60,735. The catch with other forms of apparatus amounted to 69,405 pounds, valued at $2,514.

Attention should be called to the great development of the carp fishery. In 1890 the catch of this species was unimportant, while in 1899 it amounted to 3,633,697 pounds, and was valued at $51,456. The carp is now very abundant in western Lake Erie, and there is an increased demand for it, especially in the larger towns of the Ohio and Mississippi valleys.

A number of fishery firms on Lake Erie are constructing ponds for retaining large quantities of carp until they can be disposed of to the best advantage. They are shipped to New York and other markets on the Atlantic seaboard in ice and without being dressed, while for markets south of Lake Erie they are usually dressed and skinned. Most of the carp taken in Lake Erie are procured along shore with seines, but they are also taken by other means.

The quantity and value of the carp yielded by each form of apparatus is as follows:

Apparatus.	Lbs.	Value.
Seines	3,041,308	$40,832
Pound and trap nets	291,555	5,538
Fyke nets	248,781	4,102
Gill nets	50,819	965
Minor apparatus	1,234	19

The following tables, by States and counties, relate to the number of persons employed, the capital invested, and the quantity and value of the products of the fisheries of Lake Erie in 1899:

Table showing, by States and counties, the number of persons employed in the fisheries of Lake Erie in 1899.

States and counties.	On vessels fishing.	On vessels transporting.	In shore or boat fisheries.	Shoresmen.	Total.
New York:					
Erie	38	.....	743	75	856
Chautauqua	17	.....	74	29	120
Total	55	.....	817	104	976
Pennsylvania:					
Erie	156	2	206	100	464
Ohio:					
Ashtabula	67	.....	12	37	116
Lake	12	2	36	2	52
Cuyahoga	100	5	43	154	302
Lorain	27	3	52	14	96
Erie	110	28	364	194	696
Ottawa	28	8	505	57	598
Lucas	19	9	256	24	308
Total	363	55	1,268	482	2,168
Michigan:					
Monroe	.....	8	110	2	120
Grand total	574	65	2,401	688	3,728

Table showing, by States and counties, the vessels, boats, apparatus, and capital employed in the fisheries of Lake Erie in 1899.

States and counties.	Vessels fishing.				Vessels transporting.				Boats.		Steamboats and launches.	
	No.	Tonnage.	Value.	Value of outfit.	No.	Tonnage.	Value.	Value of outfit.	No.	Value.	No.	Value.
New York:												
Erie	7	136	$24,500	$4,760	.....	.....	.....	.....	98	$3,900	.....	.....
Chautauqua	3	31	9,500	2,310	.....	.....	.....	.....	35	5,205	1	$850
Total	10	167	34,000	7,070	.....	.....	.....	.....	133	9,105	1	850
Pennsylvania:												
Erie	25	284	60,200	20,485	1	16	$1,000	$150	47	5,855	2	2,200
Ohio:												
Ashtabula	10	115	33,000	10,005	.....	.....	.....	.....	10	830	.....	.....
Lake	2	11	2,000	1,260	1	9	400	185	19	712	1	450
Cuyahoga	13	236	68,500	13,290	2	23	2,400	780	17	1,255	3	4,600
Lorain	4	35	10,700	3,841	1	13	1,000	300	25	2,390	2	1,800
Erie	14	247	57,500	12,256	8	165	37,700	5,310	163	17,045	6	5,300
Ottawa	4	117	8,500	1,162	2	50	11,000	2,005	224	17,115	2	1,500
Lucas	3	35	7,000	1,512	2	91	11,000	1,050	157	4,400	1	400
Total	50	796	187,200	43,326	16	351	63,500	9,630	615	43,747	15	14,050
Michigan:												
Monroe	.....	.....	.....	.....	2	51	10,200	3,216	63	3,659	.....	.....
Grand total	85	1,247	281,400	70,881	19	418	74,700	12,996	858	62,366	18	17,100

Table showing, by States and counties, the vessels, boats, apparatus, and capital employed in the fisheries of Lake Erie in 1899—Continued.

States and counties.	Gill nets, vessel fisheries.		Apparatus of capture, shore fisheries.											
			Pound nets.		Gill nets.		Trapnets.		Fykenets.		Seines.		Value of minor apparatus.	Value of lines.
	No.	Val.	No.	Val.	No.	Val.	No.	Val.	No.	Val.	No.	Val.		
New York:														
Erie	1,775	$9,898	.....	.....	1,060	$7,402	17	$770	.....	.....	1	$150	.....	$2,252
Chautauqua	1,220	7,235	.....	.....	2,224	14,633	7	265	.....	.....	3	250	.....	368
Total	2,995	17,133	.....	.....	3,284	22,035	24	1,035	.....	.....	4	400	.....	2,620
Pennsylvania:														
Erie	9,024	51,962	50	$19,900	2,340	14,130	102	3,710	.....	.....	.....	.....	.....	90
Ohio:														
Ashtabula	4,700	29,570	.....	.....	750	2,100	10	400	.....	.....	.....	.....	.....	30
Lake	450	2,250	40	15,200	.....	.....	28	1,120	.....	.....	1	35	.....	64
Cuyahoga	3,976	19,880	39	14,750	700	3,500	.....	.....	.....	.....	.....	.....	.....	16
Lorain	1,140	6,000	90	35,500	150	750	21	990	15	$150	.....	.....	.....	.....
Erie	4,843	24,915	252	92,050	2,573	12,252	73	2,920	244	8,165	21	1,340	$17	45
Ottawa	1,140	5,410	318	79,495	2,851	13,485	121	4,850	183	5,195	40	2,300	125	105
Lucas	750	3,750	249	22,480	12	60	4	120	113	1,620	30	3,750	.....	500
Total	16,999	91,775	988	259,475	7,036	32,147	257	10,400	555	15,130	92	7,425	142	760
Michigan:														
Monroe	.....	.....	260	33,750	.....	.....	43	1,230	62	620	8	565	.....	.....
Grand total	*29,018	160,870	1,298	313,125	*12,660	68,312	426	16,375	617	15,750	104	8,390	142	3,470

States and counties.	Shore and accessory property.	Cash capital.	Total investment.
New York:			
Erie	$122,625	$86,500	$262,757
Chautauqua	5,520	12,500	58,636
Total	128,145	99,000	321,393
Pennsylvania:			
Erie	171,420	105,000	456,102
Ohio:			
Ashtabula	29,080	38,000	143,015
Lake	17,320	.....	40,996
Cuyahoga	200,380	100,650	430,001
Lorain	25,000	.....	88,421
Erie	344,320	139,300	760,435
Ottawa	81,125	45,000	278,372
Lucas	36,890	36,750	131,282
Total	734,115	359,700	1,872,522
Michigan:			
Monroe	17,297	.....	70,537
Grand total	1,050,977	563,700	2,720,554

* Length of gill nets on vessels, 6,598,476 feet, length of gill nets in shore fisheries, 2,870,091 feet.

Table showing, by States, counties, and species, the yield of the fisheries of Lake Erie in 1899.

States and counties.	Black bass.		Rock bass.		German carp.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:								
Erie	9,053	$705			2,790	$56	107,866	$3,236
Chautauqua	1,526	117			6,715	134	28,377	851
Total	10,579	822			9,505	190	136,243	4,087
Pennsylvania:								
Erie	38,299	3,031			12,195	244	100,727	3,022
Ohio:								
Ashtabula	1,801	144			22	1	62,760	1,882
Lake	3,905	236			27,398	471	106,156	3,531
Cuyahoga	826	66			5,652	113	40,124	1,204
Lorain	3,340	268			10,806	216	16,860	506
Erie	14,288	1,049			468,165	7,152	120,971	3,663
Ottawa	56,308	3,943	5,110	$88	1,911,261	23,771	219,433	6,584
Lucas	3,246	227	186	3	993,790	15,452	137,725	4,133
Total	83,714	5,933	5,296	91	3,417,094	47,176	704,029	21,503
Michigan:								
Monroe	1,154	80			194,903	3,846	61,705	1,839
Grand total	133,746	9,866	5,296	91	3,633,697	51,466	1,002,704	30,451

States and counties.	Crappie.		Dog-fish or bow-fin.		Eels.		Pike and pickerel.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:								
Erie					200	$14		
Pennsylvania:								
Erie	60,000	$1,800					8,687	$693
Ohio:								
Cuyahoga					10	1		
Lorain							9	1
Erie					89	7		
Ottawa							11	1
Lucas							719	36
Total					99	8	739	38
Michigan:								
Monroe			540	$5	550	39	10,199	510
Grand total	60,000	1,800	540	5	849	61	19,625	1,241

States and counties.	Fresh-water drum.		Herring.		Moon-eye.		Yellow perch.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:								
Erie	7,130	$72	1,609,526	$22,041			163,056	$2,963
Chautauqua	3,000	30	1,712,032	21,513			94,876	1,428
Total	10,130	102	3,321,558	43,554			257,932	4,391
Pennsylvania:								
Erie	57,993	580	10,742,315	134,142			815,553	16,911
Ohio:								
Ashtabula			4,027,729	50,348			244,727	3,683
Lake	45,988	231	600,820	7,777			25,021	382
Cuyahoga	43,940	220	6,792,008	84,899			611,892	9,114
Lorain	20,899	105	1,387,000	18,993			100,282	1,515
Erie	442,214	3,762	4,530,154	60,317	38,451	$766	766,350	10,250
Ottawa	479,676	2,418	1,312,519	17,922	5,385	101	364,360	4,459
Lucas	11,101	56	695,756	12,546			61,932	907
Total	1,043,818	6,792	19,345,986	252,802	43,836	867	2,174,564	30,310
Michigan:								
Monroe	35,181	177	17,938	539			67,447	1,013
Grand total	1,147,122	7,651	33,427,797	431,037	43,836	867	3,315,496	52,625

Table showing, by States, counties, and species, the yield of the fisheries of Lake Erie in 1899—Continued.

States and counties.	Sturgeon.		Suckers.		Sun-fish.		Trout.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:								
Erie	508,925	$35,922	63,486	$769	.....	.....	943	$75
Chautauqua	118,508	5,075	29,884	299	.....	.....	28,299	1,435
Total	627,433	40,997	93,370	1,068	.....	.....	29,242	1,510
Pennsylvania:								
Erie	99,570	7,090	120,245	1,339	125,000	$3,750	722	61
Michigan:								
Monroe	12,305	786	183,337	2,750	13,640	205	.....	.....
Ohio:								
Ashtabula	.....	.....	11,646	118	.....	.....	1,546	124
Lake	20,906	2,567	63,673	637	.....	.....	504	40
Cuyahoga	1,712	60	30,428	305	.....	.....	10	1
Lorain	7,500	425	70,735	790	800	8	.....	.....
Erie	8,075	313	467,015	4,671	.....	.....	.....	.....
Ottawa	11,851	1,152	305,569	3,118	35,200	387	.....	.....
Lucas	50	2	222,716	3,281	800	12	.....	.....
Total	50,094	4,519	1,171,782	12,920	36,800	407	2,060	165
Grand total	789,402	53,392	1,568,734	18,077	175,440	4,362	32,024	1,736

States and counties.	Pike perch (blue pike).		Pike perch (sauger).		Pike perch (wall-eyed).		White bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:								
Erie	499,109	$21,579	9,000	$630	11,099	$668	32,719	$654
Chautauqua	309,772	8,932	115	3	11,149	557	12,713	254
Total	808,881	30,511	9,115	633	22,248	1,225	45,432	908
Pennsylvania:								
Erie	1,522,939	44,520	11,110	327	67,354	3,048	454,434	8,639
Michigan:								
Monroe	.....	.....	44,244	990	449,867	24,859	40,707	1,010
Ohio:								
Ashtabula	160,336	4,809	6,488	194	7,980	479	24,285	485
Lake	351,463	10,542	768	25	12,288	740	140,240	2,805
Cuyahoga	1,030,787	30,925	68,347	2,051	14,072	610	56,858	1,137
Lorain	243,000	3,716	76,190	2,247	42,324	2,179	202,437	4,050
Erie	392,556	13,065	1,208,685	30,265	181,081	9,131	411,459	7,183
Ottawa	3,648	110	1,216,264	27,127	586,629	24,581	204,268	3,990
Lucas	31,176	1,103	385,354	11,454	351,331	19,603	16,404	396
Total	2,212,966	64,270	2,962,096	73,363	1,195,705	57,323	1,055,951	20,046
Grand total	4,544,786	139,301	3,026,565	75,313	1,735,174	86,455	1,596,524	30,603

States and counties.	White-fish.		Turtles.		Frogs.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:								
Erie	53,522	$3,214	.....	.....	.....	.....	3,078,424	$92,598
Chautauqua	118,934	7,693	.....	.....	.....	.....	2,475,900	48,321
Total	172,456	10,907	.....	.....	.....	.....	5,554,324	140,919
Pennsylvania:								
Erie	615,821	46,690	.....	.....	.....	.....	14,852,964	275,887
Michigan:								
Monroe	228,459	18,136	.....	.....	.....	.....	1,362,176	56,784
Ohio:								
Ashtabula	265,143	20,696	.....	.....	.....	.....	4,814,463	82,963
Lake	111,896	7,845	.....	.....	.....	.....	1,511,026	37,829
Cuyahoga	62,323	4,404	.....	.....	.....	.....	8,758,989	135,110
Lorain	66,000	4,620	.....	.....	.....	.....	2,248,182	39,639
Erie	246,124	17,974	4,189	$118	.....	.....	9,299,866	169,686
Ottawa	285,077	19,701	63,022	2,206	982	$172	7,066,573	141,831
Lucas	13,015	1,036	.....	.....	.....	.....	2,925,301	70,247
Total	1,049,578	76,276	67,211	2,324	982	172	36,624,400	677,305
Grand total	2,066,314	152,009	67,211	2,324	982	172	58,393,864	1,150,895

Table showing, by States, counties, and species, the yield of the gill-net vessel fisheries of Lake Erie in 1899.

State and county.	Herring.		Suckers.		Sturgeon.		Trout.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:								
Erie	1,425,891	$19,133	5,626	$113	12,411	$659	843	$67
Chautauqua	755,393	9,442	2,797	28	8,472	321	27,286	1,365
Total	2,181,284	28,575	8,423	141	20,883	980	28,129	1,432
Pennsylvania:								
Erie	9,651,865	120,648	6,001	83	3,716	186	705	60
Ohio:								
Ashtabula	3,844,071	48,052	1,493	16	.....	.....	1,546	124
Lake	447,894	5,598	.....	.....	.....	.....	504	40
Cuyahoga	6,012,018	75,150	2,446	25	.....	.....	10	1
Lorain	725,000	9,063	.....	.....	.....	.....	.....	.....
Erie	2,818,386	37,257	2,027	20	.....	.....	.....	.....
Ottawa	806,096	10,481	195	2	.....	.....	.....	.....
Lucas	683,920	12,193	.....	.....	.....	.....	.....	.....
Total	15,337,385	197,794	6,161	63	.....	.....	2,060	165
Grand total	27,170,534	347,017	20,585	287	24,599	1,166	30,894	1,657

State and county.	Pike perch (saugers).		Pike perch (wall-eyed).		Pike perch (blue pike).	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:						
Erie	.....	.....	4,501	$225	224,948	$6,870
Chautauqua	.....	.....	5,661	283	156,027	4,681
Total	.....	.....	10,162	508	380,975	11,551
Pennsylvania:						
Erie	5,555	$169	28,740	1,138	837,951	24,921
Ohio:						
Ashtabula	4,527	136	7,892	473	151,410	4,541
Lake	513	15	.....	.....	24,575	737
Cuyahoga	30,624	919	1,698	69	387,422	11,624
Lorain	29,266	878	.....	.....	.....	.....
Erie	69,929	1,771	45	2	63,681	1,929
Ottawa	87,695	2,421	2,319	96	2,194	66
Lucas	99,686	2,990	185	7	30,776	1,083
Total	322,240	9,130	12,139	647	660,058	19,980
Grand total	327,795	9,299	51,041	2,293	1,878,984	56,452

State and county.	White bass.		White-fish.		Yellow perch.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
New York:								
Erie	662	$13	42,371	$2,542	105,487	$1,582	1,822,740	$31,204
Chautauqua	.....	.....	40,893	2,791	51,982	780	1,048,511	19,691
Total	662	13	83,264	5,333	157,469	2,362	2,871,251	50,895
Pennsylvania:								
Erie	.....	.....	415,206	33,223	543,996	8,332	11,493,735	188,760
Ohio:								
Ashtabula	.....	.....	250,460	19,521	229,858	3,449	4,491,257	76,312
Lake	.....	.....	380	30	10,304	155	484,170	6,575
Cuyahoga	3,703	74	4,130	330	440,880	6,549	6,882,931	94,741
Lorain	.....	.....	.....	.....	60,119	902	814,385	10,843
Erie	50	2	3,593	287	326,826	4,483	3,284,537	45,751
Ottawa	.....	.....	115	9	90,305	1,344	988,919	14,419
Lucas	.....	.....	1,032	83	39,875	598	855,474	16,954
Total	3,753	76	259,710	20,260	198,167	17,480	17,801,673	265,595
Grand total	4,415	89	758,180	58,816	1,899,632	28,174	32,166,659	505,250

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Erie in 1899.

Apparatus and species.	Pennsylvania. Erie County.		Michigan. Monroe County.	
	Lbs.	Value.	Lbs.	Value.
Pound nets:				
Black bass	1,139	$85	1,038	$72
Cat-fish and bullheads	7,207	216	28,115	832
Dog-fish or bowfin	.....	.....	540	5
Eels	.....	.....	150	11
Fresh-water drum	50,831	509	34,708	174
German carp	1,677	34	86,308	1,700
Herring	67,593	707	17,938	539
Moon-eye	.....	.....	36,869	554
Pike and pickerel	190	13	1,518	76
Pike perch (wall-eyed)	15,567	721	430,652	24,257
Pike perch (blue pike)	426,832	11,114	.....	.....
Pike perch (sauger)	2,404	64	43,332	962
Sturgeon	56,376	4,629	12,305	786
Suckers	31,274	332	166,549	2,497
Sun-fish	.....	.....	1,200	18
White bass	66,198	1,096	26,387	660
White-fish	77,756	4,862	*228,459	18,136
Yellow perch	33,043	496	.....	.....
Total	838,087	24,878	1,116,068	51,279
Trap nets:				
Black bass	15,160	1,186	116	8
Cat-fish and bullheads	93,520	2,806	4,743	141
Fresh-water drum	7,162	71	473	3
German carp	10,518	210	9,813	195
Herring	5,446	69	.....	.....
Pike and pickerel	.....	.....	3,217	161
Pike perch (wall-eyed)	4,988	240	17,151	501
Pike perch (blue pike)	19,151	534	.....	.....
Pike perch (sauger)	3,151	94	.....	.....
Sturgeon	10,400	471	.....	.....
Suckers	80,588	900	819	13
Sun-fish	.....	.....	7,512	113
White bass	388,236	7,543	.....	.....
White-fish	496	40	.....	.....
Yellow perch	3,066	51	16,562	248
Total	641,882	14,215	60,406	1,383
Fyke nets:				
Cat-fish and bullheads	.....	.....	28,847	866
Eels	.....	.....	400	28
German carp	.....	.....	782	16
Pike and pickerel	.....	.....	5,464	273
Pike perch (wall-eyed)	.....	.....	2,064	101
Pike perch (sauger)	.....	.....	912	28
Suckers	.....	.....	15,969	240
Sun-fish	.....	.....	4,928	74
White bass	.....	.....	14,320	350
Yellow perch	.....	.....	14,016	211
Total	.....	.....	87,702	2,187
Gill nets:				
Herring	1,017,411	12,718	.....	.....
Pike perch (wall-eyed)	13,559	544	.....	.....
Pike perch (blue pike)	200,005	6,001	.....	.....
Sturgeon	29,078	1,804	.....	.....
Suckers	2,382	24	.....	.....
Trout	17	1	.....	.....
White-fish	122,363	8,565	.....	.....
Yellow perch	55,448	832	.....	.....
Total	1,440,263	30,489	.....	.....
Seines:				
German carp	.....	.....	98,000	1,935
Lines:				
Black bass	22,000	1,760	.....	.....
Crappie	60,000	1,800	.....	.....
Pike and pickerel	8,497	680	.....	.....
Pike perch (wall-eyed)	4,500	405	.....	.....
Pike perch (blue pike)	39,000	1,950	.....	.....
Sun-fish	125,000	3,750	.....	.....
Yellow perch	180,000	7,200	.....	.....
Total	438,997	17,545	.....	.....
Grand total	3,359,229	87,127	1,362,176	56,784

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Erie in 1899—Continued.

Apparatus and species.	New York.					
	Erie County.		Chautauqua County.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Trap nets:						
Black bass	8,853	$689	1,526	$117	10,379	$806
Cat-fish and bullheads	29,166	875	5,853	175	35,019	1,050
Fresh-water drum	6,660	67	3,000	30	9,660	97
German carp	2,200	44			2,200	44
Herring	1,135	23	214	4	1,349	27
Pike perch (wall-eyed)	632	32	191	9	823	41
Pike perch (blue pike)	5,361	165	10,810	224	16,171	389
Sturgeon	1,560	78	10,633	435	12,193	513
Suckers	47,456	542	13,572	136	61,028	678
White bass	25,357	507	3,813	76	29,170	583
White-fish	51	4			51	4
Yellow perch	4,656	88	5,808	89	10,464	177
Total	133,087	3,114	55,420	1,295	188,507	4,409
Gill nets:						
Herring	182,500	2,885	956,425	12,067	1,138,925	14,952
Pike perch (wall-eyed)	366	19	5,297	265	5,663	284
Pike perch (blue pike)	106,400	3,192	142,935	4,027	249,335	7,219
Pike perch (sauger)			115	3	115	3
Sturgeon	309,598	25,896	67,087	2,981	376,685	28,877
Suckers	2,004	30	1,415	14	3,419	44
Trout	100	8	1,013	70	1,113	78
White-fish	11,100	668	78,041	4,902	89,141	5,570
Yellow perch	47,513	915	37,086	559	84,599	1,474
Total	659,581	33,613	1,289,414	24,888	1,948,995	58,501
Seines:						
Cat-fish and bullheads	5,500	165	8,600	258	14,100	423
Fresh-water drum	470	5			470	5
German carp	590	12	6,715	134	7,305	146
Suckers	8,400	84	12,100	121	20,500	205
White bass	6,700	134	8,900	178	15,600	312
Total	21,660	400	36,315	691	57,975	1,091
Lines:						
Black bass	200	16			200	16
Cat-fish and bullheads	73,200	2,196	13,924	418	87,124	2,614
Eels	200	14			200	14
Pike perch (wall-eyed)	5,600	392			5,600	392
Pike perch (blue pike)	162,400	11,352			162,400	11,352
Pike perch (sauger)	9,000	630			9,000	630
Sturgeon	185,356	9,289	32,316	1,338	217,672	10,627
Yellow perch	5,400	378			5,400	378
Total	441,356	24,267	46,240	1,756	487,596	26,023
Grand total	1,255,684	60,394	1,427,389	28,630	2,683,073	90,024

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Erie in 1899—Continued.

Apparatus and species.	Ohio.							
	Ashtabula.		Lake.		Cuyahoga.		Lorain.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Black bass			13	$2	826	$66	500	$40
Cat-fish and bullheads			20,312	956	4,124	124	12,600	378
Eels					10	1		
Fresh-water drum			45,988	231	43,940	220	14,000	70
German carp			17,998	283	5,652	113	9,392	188
Herring			152,726	2,175	254,355	3,179	570,000	8,550
Pike perch (wall-eyed)			11,523	694	12,374	541	24,000	1,440
Pike perch (blue pike)			324,213	9,725	587,108	17,613	240,000	3,600
Pike perch (sauger)			55	2	33,453	1,004	38,000	1,170
Sturgeon			20,906	2,567	1,712	60	7,500	425
Suckers			40,573	406	27,982	280	16,000	240
White bass			83,418	1,669	53,155	1,063	40,000	800
White-fish			110,526	7,736	58,193	4,074	66,000	4,620
Yellow perch			12,517	194	117,747	1,766	22,463	337
Total			840,768	26,640	1,200,631	30,104	1,060,455	21,858
Trap nets:								
Black bass	1,431	$114	3,892	234			840	68
Cat-fish and bullheads	760	22	36,200	1,086			3,360	101
Fresh-water drum							6,899	35
German carp			2,700	54			1,414	28
Herring			200	4				
Pike and pickerel							9	1
Pike perch (wall-eyed)	29	2	765	46			18,324	739
Pike perch (blue pike)	906	27	2,675	80			2,600	104
Pike perch (sauger)	1,961	58	200	8			2,024	61
Suckers	7,965	80	23,100	231			52,800	528
Sun-fish							800	8
White bass	24,111	482	56,822	1,136			112,937	2,260
White-fish	20	2	990	79				
Yellow perch	2,138	43	2,200	33			1,100	22
Total	39,321	830	129,744	2,991			203,107	3,955
Fyke nets:								
Black bass							2,000	160
Cat-fish and bullheads							900	27
Pike perch (sauger)							6,300	126
Suckers							1,800	20
White bass							49,500	990
Yellow perch							1,000	20
Total							61,500	1,343
Gill nets:								
Herring	183,658	2,296			525,635	6,570	92,000	1,380
Pike perch (wall-eyed)	46	3						
Pike perch (blue pike)	7,889	237			56,257	1,688	400	12
Pike perch (sauger)					4,270	128	600	12
Suckers							135	2
White-fish	14,663	1,173						
Yellow perch	12,731	191			53,265	799	15,600	234
Total	218,987	3,900			639,427	9,185	108,735	1,640
Seines:								
German carp			6,700	134				
Lines:								
Black bass	370	30						
Cat-fish and bullheads	62,000	1,860	49,644	1,489	36,000	1,080		
German carp	22	1						
Pike perch (wall-eyed)	13	1						
Pike perch (blue pike)	131	4						
Suckers	2,188	22						
White bass	174	3						
Total	64,898	1,921	49,644	1,489	36,000	1,080		
Grand total	323,206	6,651	1,026,856	31,254	1,876,058	40,369	1,433,797	28,796

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Erie in 1899—Continued.

Apparatus and species.	Ohio—continued.							
	Erie.		Ottawa.		Lucas.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Black bass	5,029	$398	11,854	$830	87	$6	18,309	$1,342
Cat-fish and bullheads	8,199	246	121,874	3,657	15,705	472	182,814	5,833
Eels							10	1
Fresh-water drum	341,370	2,118	478,405	2,392	11,000	55	934,703	5,086
German carp	15,070	244	28,703	536	74,255	1,466	151,070	2,830
Herring	548,791	8,243	134,049	2,189	11,836	353	1,671,757	24,689
Mooneye			4,635	93			4,635	93
Pike perch (wall-eyed)	133,209	6,857	499,038	21,375	311,865	17,579	992,009	48,486
Pike perch (blue pike)	256,143	8,684			400	20	1,407,864	39,642
Pike perch (sauger)	929,669	23,430	703,622	13,369	124,880	3,664	1,829,679	42,659
Rock bass			2,457	37	40	1	2,497	38
Sturgeon	8,075	313	11,811	1,150	50	2	50,054	4,517
Suckers	227,561	2,277	175,154	1,812	106,034	1,564	593,304	6,579
White bass	225,934	3,518	141,950	2,852	7,041	166	551,498	10,068
White-fish	185,353	13,685	126,934	8,708	10,793	858	557,799	39,681
Yellow perch	236,426	2,923	169,051	1,712	10,314	150	568,518	7,082
Total	3,120,829	72,936	2,609,537	60,712	684,300	26,356	9,516,520	238,606
Trap nets:								
Black bass	2,496	177	23,469	1,643			32,128	2,236
Cat-fish and bullheads	9,942	334	16,154	484	840	25	67,256	2,052
Fresh-water drum			1,096	22	101	1	8,096	58
German carp	12,700	181	11,314	225	1,841	37	29,969	525
Herring	40	1	35	1			275	6
Pike and pickerel					719	36	728	37
Pike perch (wall-eyed)	17,200	818	33,709	1,188	2,311	117	72,338	2,910
Pike perch (blue pike)							6,181	211
Pike perch (sauger)	13,361	401	170,044	3,195			187,590	3,723
Rock bass			1,106	17			1,106	17
Sturgeon			40	2			40	2
Suckers	125,845	1,258	63,982	641	500	8	274,192	2,746
Sun-fish					800	12	1,600	20
White bass	132,652	2,630	46,722	934			373,244	7,442
White-fish			250	18			1,260	99
Yellow perch	24,642	367	25,627	256	4,600	69	60,307	790
Total	338,878	6,167	393,548	8,626	11,712	305	1,116,310	22,874
Fyke nets:								
Black bass	6,570	460	3,230	226	3,159	221	14,959	1,067
Cat-fish and bullheads	64,893	1,946	29,528	887	23,180	696	118,501	3,556
Eels	89	7					89	7
Fresh-water drum	100,844	1,644	175	4			101,019	1,648
German carp	114,591	1,790	90,833	1,474	42,575	822	247,999	4,086
Mooneye	37,286	743	750	8			38,036	751
Pike perch (wall-eyed)	27,367	1,325	45,008	1,565	22,970	1,240	95,345	4,130
Pike perch (blue pike)	2,472	124					2,472	124
Pike perch (sauger)	137,871	2,758	66,915	944	16,369	467	227,455	4,295
Rock bass			1,447	32	146	2	1,593	34
Suckers	106,813	1,068	58,756	588	57,282	825	224,651	2,501
Sun-fish			2,700	32			2,700	32
White bass	52,623	1,029	15,519	202	9,363	230	127,005	2,451
White-fish			189	12			189	12
Yellow perch	37,007	370	21,879	221	7,143	90	67,029	701
Total	688,426	13,264	336,929	6,195	182,187	4,593	1,269,042	25,395

Table showing, by States, counties, apparatus, and species, the yield of the shore fisheries of Lake Erie in 1899—Continued.

Apparatus and species.	Ohio—continued.							
	Erie.		Ottawa.		Lucas.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:								
Black bass			59	$5			59	$5
Cat-fish and bullheads	186	$6	501	15			687	21
German carp	20,507	358	30,312	607			50,819	965
Herring	1,161,937	14,786	367,339	5,101			2,330,569	30,133
Pike and pickerel			11	1			11	1
Pike perch (wall-eyed)	715	43	878	42			1,639	88
Pike perch (blue pike)	70,260	2,328	1,454	44			136,260	4,309
Pike perch (sauger)	35,304	853	65,705	1,152			105,879	2,145
Suckers	4,084	41	5,097	51			9,316	94
White bass			77	2			77	2
White-fish	57,178	4,002	157,589	10,954	1,190	$95	230,620	16,224
Yellow perch	133,903	1,930	24,821	349			240,320	3,503
Total	1,484,074	24,347	653,843	18,323	1,190	95	3,106,256	57,490
Seines:								
Black bass	193	14	17,696	1,239			17,889	1,253
Cat-fish and bullheads	8,158	243	26,256	787			34,414	1,030
German carp	304,085	4,561	1,750,099	20,929	875,119	13,127	2,936,003	38,751
Mooneye	1,165	23					1,165	23
Pike perch (wall-eyed)	2,345	70	1,877	69	14,000	660	18,222	799
Pike perch (sauger)	2,533	51	2,283	46	144,419	4,333	149,235	4,430
Rock bass			100	2			100	2
Suckers	685	7	2,385	24	58,900	884	61,970	915
Sun-fish			32,500	355			32,500	355
White bass	200	4					200	4
Yellow perch	2,468	25	7,677	77			10,145	102
Total	321,832	4,998	1,840,873	23,528	1,092,438	19,004	3,261,843	47,664
Lines:								
Black bass							370	30
Cat-fish and bullheads	29,593	888	25,120	754	98,000	2,940	300,357	9,011
German carp							22	1
Herring	1,000	30	5,000	150			6,000	180
Pike perch (wall-eyed)							2,188	22
Pike perch (blue pike)	200	16	3,800	246			4,013	263
Pike perch (sauger)							131	4
White bass	20,018	1,001	120,000	6,000			140,018	7,001
White-fish							174	3
Yellow perch	5,078	152	25,000	500			30,078	652
Total	55,889	2,087	178,920	7,650	98,000	2,940	483,351	17,167
Minor apparatus:								
Frogs			982	172			982	172
German carp	1,212	18					1,212	18
Turtles	4,189	118	63,022	2,206			67,211	2,324
Total	5,401	136	64,004	2,378			69,405	2,514
Grand total	6,015,329	123,935	6,077,654	127,412	2,069,827	53,293	18,822,727	411,710

Summary of the yield of the shore fisheries of Lake Erie in 1899.

Apparatus and species.	Lbs.	Value.
Pound nets:		
Black bass	20,486	$1,499
Cat-fish and bullheads	218,136	6,881
Dog-fish or bowfin	540	5
Eels	160	12
Fresh-water drum	1,020,242	5,769
German carp	239,055	4,564
Herring	1,757,288	25,935
Mooneye	41,504	647
Pike and pickerel	1,708	89
Pike perch (wall-eyed)	1,438,228	73,464
Pike perch (blue pike)	1,831,696	50,756
Pike perch (sauger)	1,875,415	43,665
Rock bass	2,497	38
Sturgeon	118,735	9,932
Suckers	791,127	9,408
Sun-fish	1,200	18
White bass	644,083	11,824
White-fish	864,014	62,679
Yellow perch	601,561	7,578
Total	11,470,675	314,763
Trap nets:		
Black bass	57,783	4,236
Cat-fish and bullheads	200,538	6,049
Fresh-water drum	25,391	229
German carp	52,500	974
Herring	7,070	102
Pike and pickerel	3,945	198
Pike perch (wall-eyed)	95,300	3,692
Pike perch (blue pike)	41,503	1,134
Pike perch (sauger)	190,741	3,817
Rock bass	1,106	17
Sturgeon	22,633	986
Suckers	416,627	4,337
Sun-fish	9,112	133
White bass	790,650	15,568
White-fish	1,807	143
Yellow perch	90,399	1,266
Total	2,007,105	42,881
Fyke nets:		
Black bass	14,959	1,067
Cat-fish and bullheads	147,348	4,422
Eels	489	35
Fresh-water drum	101,019	1,648
German carp	248,781	4,102
Mooneye	38,036	751
Pike and pickerel	5,464	273
Pike perch (wall-eyed)	97,409	4,231
Pike perch (blue pike)	2,472	124
Pike perch (sauger)	228,367	4,323
Rock bass	1,593	34
Suckers	240,620	2,741
Sun-fish	7,628	106
White bass	141,325	2,801
White-fish	189	12
Yellow perch	81,045	912
Total	1,356,744	27,582
Gill nets:		
Black bass	59	$5
Cat-fish and bullheads	687	21
German carp	50,819	965
Herring	4,486,905	57,803
Pike and pickerel	11	1
Pike perch (wall-eyed)	20,861	916
Pike perch (blue pike)	585,600	17,529
Pike perch (sauger)	105,994	2,148
Sturgeon	405,763	30,681
Suckers	15,117	162
Trout	1,130	79
White bass	77	2
White-fish	442,124	30,359
Yellow perch	380,367	5,809
Total	6,495,514	146,480
Seines:		
Black bass	17,889	1,253
Cat-fish and bullheads	48,514	1,453
Fresh-water drum	470	5
German carp	3,041,308	40,832
Mooneye	1,165	23
Pike perch (wall-eyed)	18,222	799
Pike perch (sauger)	149,235	4,430
Rock bass	100	2
Suckers	82,470	1,120
Sun-fish	32,500	355
White bass	15,800	316
Yellow perch	10,145	102
Total	3,417,818	50,690
Lines:		
Black bass	22,570	1,806
Cat-fish and bullheads	387,481	11,625
Crappie	60,000	1,800
Eels	200	14
German carp	22	1
Herring	6,000	180
Pike and pickerel	8,497	680
Pike perch (wall-eyed)	14,113	1,060
Pike perch (blue pike)	201,531	13,306
Pike perch (sauger)	149,018	7,631
Sturgeon	217,672	10,627
Suckers	2,188	22
Sun-fish	125,000	3,750
White bass	174	3
Yellow perch	215,478	8,230
Total	1,409,944	60,735
Minor apparatus:		
Frogs	982	172
German carp	1,212	18
Turtles	67,211	2,324
Total	69,405	2,514
Grand total	26,227,205	645,645

WHOLESALE FISHERY TRADE.

The wholesale trade in fishery products is very important along Lake Erie, and is carried on at all the principal cities and towns. There are 42 establishments engaged, representing a total investment of $1,305,380. They were valued at $741,680, and the cash capital utilized was $563,700. The persons employed numbered 615, and the amount paid in wages was $209,714. The total quantity of products handled was 61,369,911 pounds, valued at $1,664,838. These products include, of course, a portion of the catch from the Canadian side of the lake.

In the year 1899 the quantity of fresh fish imported at Sandusky was 3,500,298 pounds and of salted fish 650 pounds. The quantity imported at Buffalo amounted to 6,669,004 pounds of fresh fish, 43,877 pounds of salted fish, 152,080 pounds of skinned and boned fish, and 195 pounds of canned fish.

The cities in which the trade is most extensive are Sandusky, Erie, Cleveland, Toledo, and Buffalo.

Several fishery firms at each of these cities have considerable capital invested in fishing apparatus, principally pound nets, on the Canadian side of the lake, and a large proportion of the products imported was procured by this means.

Table showing the wholesale fishery trade of Lake Erie in 1899.

Items.	Toledo, Ohio.		Port Clinton, Ohio.		Sandusky, Ohio.		Vermilion, Ohio.		Cleveland, Ohio.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Establishments	4	$31,180	2	$30,000	9	$206,000	2	$30,000	9	$139,230
Cash capital		36,750		45,000		103,800		35,500		100,650
Wages paid		6,457		13,032		37,620		10,000		41,088
Employees	22		45		146		61		108	
Products handled.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Fresh:										
Black bass			16,601	$1,494	27,658	$2,441	959	$96	1,738	$174
Cat-fish and bullheads	166,390	$5,455	206,396	8,256	114,494	7,041	17,368	695	74,252	3,290
Eels					172	11	1,020	68	1,555	117
Fresh-water drum	735,000	4,225			857,788	3,873	571	3	55,045	464
German carp	550,574	7,183	2,900,652	43,510	501,142	7,928	3,809	29	32,340	639
Herring	1,181,346	35,439	245,104	7,353	3,876,144	88,794	1,752,420	28,810	5,328,090	104,475
Ling									5,685	144
Pike perch:										
Wall-eyed	2,165,142	117,878	374,763	17,010	839,236	30,091	1,160	81	103,299	7,747
Blue pike					142,914	4,288	40,026	1,188	1,169,544	35,133
Sauger	641,207	16,030	536,395	8,046	1,175,628	21,215	56,690	1,417	92,140	2,206
Rock bass					62	2				
Sturgeon, dressed	12,568	1,274	7,525	602	126,485	14,890			19,561	1,889
Suckers	582,057	7,370			255,143	3,034	31,197	234	44,158	632
Sun-fish					72,669	1,090				
Trout	36,736	2,573			10,718	857			148,250	10,918
White bass	48,668	1,251	151,156	3,654	158,524	4,601	17,105	428	95,073	2,439
White-fish	717,992	53,473	69,739	5,579	331,971	25,961	908	64	301,765	24,584
Yellow perch	183,056	3,910	81,673	1,633	437,111	7,787	209,914	2,413	636,434	12,729
Caviar	2,188	1,533	220	198	81,040	60,780				
Frogs					3,960	82				
Turtles					3,789	189				
Total	7,022,924	257,594	4,590,224	97,335	9,016,648	284,955	2,133,147	35,526	8,108,929	207,580
Salted:										
Herring					160,000	4,000	140,500	2,810	1,145,000	30,300
Smoked:										
Eels	1,000	150							300	54
Herring	124,800	7,488			314,900	6,792			700,667	35,033
Sturgeon	2,667	480			29,500	4,860			31,734	5,496
Trout									28,650	4,011
Total	128,467	8,118			344,400	11,652			761,351	44,594
Miscellaneous:										
Oil					135,000	3,750				
Scrap					2,000,000	5,000				
Total					2,135,000	8,750				
Grand total	7,151,391	265,712	4,590,224	97,335	11,656,048	309,357	2,273,647	38,336	10,015,280	282,474

Table showing the wholesale fishery trade of Lake Erie in 1899—Continued.

Items.	Ashtabula Harbor, Ohio.		Erie, Pennsylvania.		Dunkirk and Barcelona, New York.		Buffalo, New York.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Establishments	3	$24,000	4	$158,100	4	$3,650	5	$119,520
Cash capital		38,000		105,000		12,500		86,500
Wages paid		9,840		38,735		3,900		48,742
Employees	31		100		27		75	
Products handled.	**Lbs.**	**Valuc.**	**Lbs.**	**Value.**	**Lbs.**	**Value.**	**Lbs.**	**Value.**
Fresh:								
Black bass	1,915	$192	20,771	$1,801	4,000	$300	22,000	$1,980
Cat-fish and bullheads	5,244	210	13,704	575	2,000	70	28,400	1,278
Fresh-water drum			67,652	1,258	2,000	25	40,000	500
German carp	95	4	7,396	146	1,500	30		
Herring	2,846,621	45,299	7,107,618	143,203	1,332,073	22,641	6,060,967	121,219
Pickerel			7,360	447			27,000	2,160
Pike perch (wall-eyed)	16,301	693	48,966	3,764	15,733	1,101	7,845	627
Pike perch (blue pike)	212,509	6,329	1,162,513	44,608	291,479	9,859	415,850	16,634
Pike perch (sauger)	2,394	72	2,303	92				
Sturgeon, dressed			40,840	3,860	6,080	518	97,545	9,755
Suckers	2,316	37	54,674	1,035	18,017	248	42,000	840
Sun-fish					2,000	25		
Trout			24,867	1,990	49,538	3,468	29,100	2,619
White bass	1,015	25	46,871	1,226	2,500	31	6,645	133
White-fish	248,183	11,585	500,217	39,840	60,010	4,182	193,000	17,370
Yellow perch	322,768	5,242	407,825	11,278	55,903	1,232	346,300	10,389
Caviar			6,559	5,267	346	216	7,202	5,207
Isinglass							208	31
Total	3,659,361	69,688	9,520,136	260,390	1,843,179	43,946	7,324,062	190,742
Salted:								
Herring	1,100,000	24,750	1,633,900	40,847			244,033	2,030
Smoked:								
Eels			16,125	806			700	105
Herring							204,000	15,120
Sturgeon			5,600	728			132,000	22,440
Trout							225	32
Total			21,725	1,534			336,925	37,697
Grand total	4,759,361	94,438	11,175,761	302,771	1,843,179	43,946	7,905,020	230,469

Summary of the wholesale trade of Lake Erie in 1899.

Products handled.	Lbs.	Value.	Products handled.	Lbs.	Value.
Fresh:			Fresh—continued.		
Black bass	95,642	$8,478	Frogs	3,960	$82
Cat-fish and bullheads	628,248	26,870	Turtles	3,789	189
Eels	2,747	196			
Fresh-water drum	1,758,056	10,348	Total	53,218,610	1,447,756
German carp	3,997,508	59,469			
Herring	29,730,383	597,233	Salted:		
Ling	5,685	144	Herring	4,423,433	104,737
Pickerel	34,360	2,607	Smoked:		
Pike perch (wall-eyed)	3,572,445	178,992	Eels	18,125	1,115
Pike perch (blue pike)	3,434,835	118,039	Herring	1,344,367	64,433
Pike perch (sauger)	2,506,757	49,078	Sturgeon	201,501	34,004
Rock bass	62	2	Trout	28,875	4,043
Sturgeon, dressed	310,604	32,788	Total	1,592,868	103,595
Suckers	1,029,562	13,430			
Sun-fish	74,669	1,115	Miscellaneous:		
Trout	299,209	22,425	Oil	*135,000	3,750
White bass	527,557	13,788	Scrap	2,000,000	5,000
White-fish	2,423,785	182,638			
Yellow perch	2,680,984	56,613	Total	2,135,000	8,750
Caviar	97,555	78,201			
Isinglass	208	31	Grand total	61,369,911	1,664,838

*15,000 gallons.

FISHERIES OF LAKE ONTARIO.

The fishing industry of Lake Ontario in 1899 gave employment to 315 persons, 297 of whom were engaged in the shore fisheries, the remainder being employed as shoresmen and on vessels transporting.

The total investment in the fisheries of the lake was $78,543. Of this sum $55,348 is credited to Jefferson County. The fishing apparatus in which the greatest amount of capital was invested was gill nets, the number employed being 1,187, valued at $18,674. Next in importance were 144 trap nets, valued at $5,790, and 451 fyke nets, valued at $5,412.

The yield of the fisheries of Lake Ontario in 1899 amounted to 2,311,262 pounds, valued at $93,393. The principal species taken were: White-fish, 161,935 pounds, valued at $10,978; herring, 85,478 pounds, valued at $3,736; pike perch, 197,436 pounds, valued at $10,266; pike and pickerel, 100,365 pounds, valued at $5,861; yellow perch, 397,117 pounds, valued at $11,426; cat-fish and bullheads, 518,423 pounds, valued at $18,834; eels, 123,840 pounds, valued at $6,163; sturgeon, 139,385 pounds, valued at $12,049. Other species taken in important quantities were suckers, sun-fish, and rock bass.

The most important form of apparatus of capture with respect to the quantity of fish taken was fyke nets, which yielded 833,982 pounds, the principal species being cat-fish and bullheads, yellow perch, suckers, sun-fish, and eels. Gill nets yielded 703,077 pounds, consisting chiefly of white-fish, pike perch, yellow perch, and herring. Pound and trap nets produced 551,975 pounds, consisting principally of cat-fish and bullheads, yellow perch, and pickerel.

The quantities taken in other forms of apparatus were much smaller. The set-line fishery, which is carried on chiefly for sturgeon, yielded 75,905 pounds.

As compared with the year 1893, there has been an increase of 74 in the number of persons employed; $22,412, or nearly 40 per cent, in the amount of capital invested; 1,383,247 pounds, or 149 per cent, in the quantity, and $61,883, or 196 per cent, in the value of products. The increased yield of this lake in 1899 consisted almost wholly in the cheaper varieties of fishes. The only increase among the more valuable species was in white-fish, sturgeon, and trout, the yield of which was more than twice that of 1893.

The imports of fresh fish from Canada entered at custom-houses on Lake Ontario and the Niagara River during the year 1899 aggregated 2,650,939 pounds, the greater part of which was consumed in the interior towns of the State of New York.

The following tables present by counties the statistics of the fisheries of Lake Ontario for the year 1899:

Table showing, by counties, the persons employed in the fisheries of Lake Ontario in 1899.

Counties.	On vessels transporting.	In shore fisheries.	Shoresmen.	Total.
Jefferson		130	12	142
Oswego	2	17	1	20
Cayuga		9		9
Wayne	3	39		42
Monroe		17		17
Orleans		26		26
Niagara		59		59
Total	5	297	13	315

Table showing, by counties, the vessels, boats, apparatus, and capital employed in the fisheries of Lake Ontario in 1899.

Items.	Jefferson.		Oswego.		Cayuga.		Wayne.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting			1	$400			1	$600
Tonnage			8				14	
Outfit				50				40
Boats	119	$3,202	13	585	9	$360	27	815
Apparatus of capture:								
Seines	2	50					4	65
Gill nets	507	8,743	54	1,500	2	5	110	950
Pound nets	1	60						
Trap nets	125	5,000	14	540			4	200
Fyke nets	328	4,110	9	90	15	150	50	600
Hand lines		19				12		6
Set lines, yards	9,501	171	35,834	118			8,334	25
Spears	6	3						
Shore and accessory property		13,990		1,065		25		815
Cash capital		20,000		200				
Total		55,348		4,548		552		4,116

Items.	Monroe.		Orleans		Niagara.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting							2	$1,000
Tonnage							22	
Outfit								90
Boats	12	$455	18	$795	35	$1,910	233	8,122
Apparatus of capture:								
Seines			1	3	1	8	*8	126
Gill nets	88	440	52	1,042	374	5,994	†1,187	18,674
Pound nets							1	60
Trap nets					1	50	144	5,790
Fyke nets	18	200	15	150	16	112	451	5,412
Dip nets	4	20					4	20
Hand lines								37
Set lines, yards	3,334	10	27,668	153	99,668	472	184,339	949
Spears							6	3
Shore and accessory property		215		285		1,665		18,060
Cash capital								20,200
Total		1,340		2,428		10,211		78,543

*Total length, 407 yards. †Total length, 151,085 yards.

Table showing, by counties and species, the yield of the fisheries of Lake Ontario in 1899.

Species.	Jefferson.		Oswego.		Cayuga.		Wayne.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	39,965	$2,398			2,500	$200	5,581	$535
Cat-fish and bullheads	329,991	11,474	15,914	$552	7,200	288	43,868	1,701
Eels	118,034	5,902	1,706	57	400	20	2,552	127
German carp	1,000	50						
Herring, fresh	5,750	281					18,396	781
Herring, salted	25,600	1,024						
Minnows							800	50
Pike and pickerel	46,339	2,789	1,410	71	2,500	200	33,955	1,862
Pike perch (blue pike)	20,773	1,009	9,436	472			27,714	1,485
Pike perch (wall-eyed)	9,385	750	150	8	700	56		
Rock bass	26,450	265	26,000	520			38,778	1,112
Sturgeon	30,086	1,741	20,887	2,066			3,000	340
Suckers	124,764	1,434	38,700	774	1,200	36	67,474	1,987
Sun-fish	107,129	1,070	11,900	238	2,100	63	20,032	553
Trout	14,400	774						
White-fish	14,280	986					460	28
White-fish (long-jaw)					1,200	72	100	5
Yellow perch	149,938	2,070	25,600	707	7,200	304	69,769	2,823
Frogs	1,750	306						
Total	1,065,634	34,323	151,703	5,465	25,000	1,239	332,479	13,389

Species.	Monroe.		Orleans.		Niagara.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass							48,046	$3,133
Cat-fish and bullheads	16,850	$635	22,200	$888	82,400	$3,296	518,423	18,834
Eels	548	27			600	30	123,840	6,163
German carp							1,000	50
Herring, fresh	26,106	1,195	800	56	8,826	399	59,878	2,712
Herring, salted							25,600	1,024
Minnows			500	25	2,700	135	4,000	210
Pike and pickerel	3,561	204	2,100	105	10,500	630	100,365	5,861
Pike perch (blue pike)	4,127	221	6,846	347	118,100	5,905	186,996	9,439
Pike perch (wall-eyed)	175	11			30	2	10,440	827
Rock bass	3,900	117	1,596	59	6,244	250	102,968	2,323
Sturgeon	2,943	449	29,539	2,736	52,930	4,717	139,385	12,049
Suckers	10,400	272	4,000	100	17,800	426	264,338	5,029
Sun-fish	2,888	87			4,400	88	148,449	2,099
Trout			25	2	1,007	77	15,432	853
White-fish	80	5	17,215	1,174	129,900	8,785	161,935	10,978
White-fish (long-jaw)							1,300	77
Yellow perch	25,285	924	14,050	565	105,275	4,033	397,117	11,426
Frogs							1,750	306
Total	96,863	4,147	98,871	6,057	540,712	28,773	2,311,262	93,393

Table showing, by counties, apparatus, and species, the yield of the fisheries of Lake Ontario in 1899.

Apparatus and species.	Jefferson.		Oswego.		Cayuga.		Wayne.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:								
Black bass							1,381	$115
Cat-fish and bullheads							1,800	18
Herring, fresh							18,396	781
Herring, salted	25,600	$1,024						
Pike and pickerel	6,400	384	800	$40	800	$64	27,411	1,382
Pike perch (blue pike)	5,800	260	6,100	305			19,073	1,041
Rock bass							2,845	85
Sturgeon	21,680	1,285	13,370	1,325			1,200	184
Suckers			3,600	72			6,800	204
Trout	14,400	774						
White-fish	8,000	484					250	15
White-fish (long-jaw)					1,200	72	100	5
Yellow perch	5,600	112	9,000	270	2,600	104	21,864	913
Total	87,480	4,323	32,870	2,012	4,600	240	101,120	4,743
Pound nets and trap nets:								
Black bass	11,765	824						
Cat-fish and bullheads	103,622	3,628	1,600	40			1,400	56
Eels	79,321	3,966	1,100	33			225	11
German carp	1,000	50						
Herring	5,750	281						
Pike and pickerel	24,546	1,491	210	11				
Pike perch (wall-eyed)	9,385	750	150	8				
Pike perch (blue pike)	14,973	749	3,336	167			1,200	72
Rock bass	21,950	220	26,000	520			5,100	102
Sturgeon	1,440	104						
Suckers	50,020	687	27,900	558			5,500	128
Sun-fish	36,551	365	8,100	162			4,812	96
White-fish	6,280	502					210	13
Yellow perch	58,829	923	10,500	315			4,200	126
Total	425,432	14,540	78,896	1,814			22,647	604
Fyke nets:								
Cat-fish and bullheads	218,369	7,566	14,314	512	7,200	288	34,684	1,387
Eels	38,113	1,906	606	24	400	20	1,706	85
Pike and pickerel	14,093	836	400	20	500	40	1,444	72
Pike perch (blue pike)							7,441	372
Rock bass	3,500	35					25,300	759
Suckers	57,944	579	7,200	144	1,200	36	35,664	1,070
Sun-fish	69,858	698	3,800	76	2,100	63	9,820	295
Yellow perch	83,709	1,017	6,100	122	3,000	120	16,100	588
Total	485,586	12,637	32,420	898	14,400	567	132,159	4,628
Seines:								
Cat-fish and bullheads	8,000	280					5,984	240
Eels	600	30					621	31
Minnows							800	50
Pike and pickerel	1,300	78						
Rock bass	1,000	10					5,533	166
Suckers	16,800	168					19,510	585
Sun-fish	720	7					5,400	162
Yellow perch	1,800	18					12,405	506
Total	30,220	591					50,253	1,740
Hand lines:								
Black bass	28,200	1,574			2,500	200	4,200	420
Pike and pickerel					1,200	96	5,100	408
Pike perch (wall-eyed)					700	56		
Yellow perch					1,600	80	15,200	690
Total	28,200	1,574			6,000	432	24,500	1,518
Set lines:								
Sturgeon	6,966	352	7,517	741			1,800	156
Dip nets and spears:								
Frogs	1,750	306						
Grand total	1,065,634	34,323	151,703	5,465	25,000	1,239	332,479	13,389

Table showing, by counties, apparatus, and species, the yield of the fisheries of Lake Ontario in 1899—Continued.

Apparatus and species.	Monroe.		Orleans.		Niagara.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:						
Herring, fresh	26,106	$1,195	800	$56	8,826	$399
Pike and pickerel	2,705	157	.....	.....	.....	.....
Pike perch (wall-eyed)	.....	.....	.....	.....	30	2
Pike perch (blue pike)	4,127	221	6,846	347	118,100	5,905
Rock bass	.....	.....	1,596	59	6,244	250
Sturgeon	.....	.....	10,060	842	15,730	1,466
Trout	.....	.....	25	2	1,007	77
White-fish	80	5	17,215	1,174	129,900	8,785
Yellow perch	13,385	493	12,750	513	101,475	3,919
Total	46,403	2,071	49,292	2,993	381,312	20,803
Pound nets and trap nets:						
Cat-fish and bullheads	.....	.....	.....	.....	12,400	496
Eels	.....	.....	.....	.....	600	30
Suckers	.....	.....	.....	.....	3,800	76
Sun-fish	.....	.....	.....	.....	4,400	88
Yellow perch	.....	.....	.....	.....	3,800	114
Total	.....	.....	.....	.....	25,000	804
Fyke nets:						
Cat-fish and bullheads	16,850	635	22,200	888	70,000	2,800
Eels	548	27	.....	.....	.....	.....
Pike and pickerel	856	47	2,100	105	10,500	630
Pike perch (wall-eyed)	175	11	.....	.....	.....	.....
Rock bass	3,900	117	.....	.....	.....	.....
Suckers	10,400	272	4,000	100	14,000	350
Sun-fish	2,888	87	.....	.....	.....	.....
Yellow perch	9,700	321	1,300	52	.....	.....
Total	45,317	1,517	29,600	1,145	94,500	3,780
Seines:						
Minnows	.....	.....	500	25	2,700	135
Set lines:						
Sturgeon	2,943	449	19,479	1,894	37,200	3,251
Dip nets:						
Yellow perch	2,200	110	.....	.....	.....	.....
Grand total	96,863	4,147	98,871	6,057	540,712	28,773

Summary showing the products of the fisheries of Lake Ontario in 1899.

Apparatus and species.	Lbs.	Value.
Gill nets:		
Black bass	1,381	$115
Cat-fish and bullheads	1,800	18
Herring, fresh	54,128	2,431
Herring, salted	25,600	1,024
Pike and pickerel	38,116	2,027
Pike perch (wall-eyed)	30	2
Pike perch (blue pike)	160,046	8,079
Rock bass	10,685	394
Sturgeon	62,040	5,102
Suckers	10,400	276
Trout	15,432	853
White-fish	155,445	10,463
White-fish (long-jaw)	1,300	77
Yellow perch	166,674	6,324
Total	703,077	37,185
Pound nets and trap nets:		
Black bass	11,765	824
Cat-fish and bullheads	119,022	4,220
Eels	81,246	4,040
German carp	1,000	50
Herring	5,750	281
Pike and pickerel	24,756	1,502
Pike perch (wall-eyed)	9,535	758
Pike perch (blue pike)	19,509	988
Rock bass	53,050	842
Sturgeon	1,440	104
Suckers	87,220	1,449
Sun-fish	53,863	711
White-fish	6,490	515
Yellow perch	77,329	1,478
Total	551,975	17,762
Fyke nets:		
Cat-fish and bullheads	383,617	14,076
Eels	41,373	2,062
Fyke nets—continued:		
Pike and pickerel	29,893	$1,750
Pike perch (wall-eyed)	175	11
Pike perch (blue pike)	7,441	372
Rock bass	32,700	911
Suckers	130,408	2,551
Sun-fish	88,466	1,219
Yellow perch	119,909	2,220
Total	833,982	25,172
Seines:		
Cat-fish and bullheads	13,984	520
Eels	1,221	61
Minnows	4,000	210
Pike and pickerel	1,300	78
Rock bass	6,533	176
Suckers	36,310	753
Sun-fish	6,120	169
Yellow perch	14,205	524
Total	83,673	2,491
Hand lines:		
Black bass	34,900	2,194
Pike and pickerel	6,300	504
Pike perch (wall-eyed)	700	56
Yellow perch	16,800	770
Total	58,700	3,524
Set lines:		
Sturgeon	75,905	6,843
Dip nets and spears:		
Yellow perch	2,200	110
Frogs	1,750	306
Total	3,950	416
Grand total	2,311,262	93,393

FISHERIES OF THE ST. LAWRENCE RIVER.

The fisheries of the St. Lawrence River employed 69 persons, the investment amounted to $1,323, and the catch, consisting of sturgeon, minnows, and suckers, amounted to 81,900 pounds, worth $6,988. The minnows taken in these waters are sold to sportsmen for bait.

Table showing, by counties, the persons, apparatus, etc., employed in the fisheries of the St. Lawrence River in 1899.

Items.	St. Lawrence.		Jefferson.		Total.	
	No.	Value.	No.	Value.	No.	Value.
Fishermen	48		21		69	
Boats	43	$250	11	$110	54	$360
Seines	3	60	13	234	16	294
Set lines		360		9		69
Shore property		300				300
Total		970		353		1,323

Table showing, by counties, apparatus, and species, the yield of the fisheries of the St. Lawrence River in 1899.

Apparatus and species.	St. Lawrence.		Jefferson.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:						
Minnows	800	$40	17,900	$1,343	18,700	$1,383
Suckers	14,400	72			14,400	72
Total	15,200	112	17,900	1,343	33,100	1,455
Set lines:						
Sturgeon	48,000	5,400	800	133	48,800	5,533

FISHERIES OF NIAGARA RIVER.

The fisheries of the Niagara River were of minor importance; the yield, consisting of perch, white bass, and sturgeon, was 13,170 pounds, valued at $616. Practically all of the catch from this river was taken in a form of apparatus known locally as a "fishing machine." The use of this unique device, which was prohibited for a number of years, has recently been permitted by the State of New York, within the limits of the town of Lewiston. It consists of a framework of timbers extending out from the shore about 20 or 30 feet, which is heavily weighted with large stones to prevent its being carried away by the swift current. In the center of the covering of this framework is a well or opening enclosed on all sides except the one facing down the river. A square wooden box with sides about 8 inches in height and a bottom of fine-meshed iron screen, arranged to fit loosely in this space, is raised and lowered by means of a windlass. When in use the fish passing close to the shore to avoid the current enter the sunken box, which is raised to the level of the platform about every half hour. The apparatus is in use from about the middle of May until late in the fall. The remainder of the catch from this river, consisting of sturgeon, is taken by Indians with spears.

The fisheries of this river are all to be credited to Niagara County.

Table showing persons, apparatus, etc., employed in the fisheries of Niagara River in 1899.

Items.	No.	Value.
Fishermen	7	.....
Fishing machines	4	$400
Spears	3	4
Shore property	.....	80
Total	.....	484

Table showing, by apparatus and species, the yield of the fisheries of Niagara River in 1899.

Apparatus and species.	Lbs.	Value.
Fishing machines:		
Yellow perch	9,900	$396
Sturgeon	300	18
White bass	2,300	92
Total	12,500	506
Spears:		
Sturgeon	670	110

THE FISHERIES CONSIDERED BY STATES.

There are eight States bordering on the Great Lakes, all of which are interested in the fisheries. The States located on more than one lake are Michigan, which borders on four lakes, and New York and Wisconsin each on two lakes.

In Michigan 3,427 persons were employed in 1899; in Ohio, 2,168; in New York, 1,367, and in Wisconsin, 1,352. In each of the other States the fisheries are comparatively limited in extent and therefore give employment to a much smaller number of persons.

The investment in Ohio was $1,872,522, being larger than in any other State. Next in importance is this respect is Illinois, which has an investment of $1,871,341, although its fisheries are not extensive. The greater part of this amount, however, represents the capital utilized in the wholesale fishery trade of Chicago. Michigan has an investment of $1,287,448, Wisconsin $619,339, Pennsylvania $456,102, New York $401,743, Minnesota $76,007, and Indiana $33,214.

The value of the yield is perhaps a better basis on which to determine the importance of the Great Lakes fisheries in the various States than either the number of persons employed or the amount of capital invested. The products of the fisheries of Michigan, which were greater in value than those of any other State in this region, aggregated 32,368,852 pounds, valued at $894,060. The fisheries of Ohio exceeded those of any of the other States in the quantity of products, the yield being 36,624,400 pounds, valued at $677,305. Wisconsin's fisheries produced 19,530,430 pounds, valued at $454,165. The value of the fishery products in other States was as follows: Pennsylvania $275,887, New York $241,916, Illinois $37,284, Indiana $16,490, and Minnesota $14,332.

In the following tables the fisheries of the Great Lakes for 1899 are presented by States, while States bordering on more than one lake are also treated in separate tables:

Table showing the number of persons employed in the fisheries of the Great Lakes in 1899.

States.	On vessels fishing.	On vessels transporting.	In shore fisheries.	Shoresmen.	Total.
New York	55	5	1,190	117	1,367
Pennsylvania	156	2	206	100	464
Ohio	363	55	1,268	482	2,168
Michigan	321	15	2,632	459	3,427
Indiana	8	.....	42	6	56
Illinois	20	.....	286	379	685
Wisconsin	233	15	906	198	1,352
Minnesota	.....	.....	127	24	151
Total	1,156	92	6,657	1,765	9,670

Table showing, by States, the apparatus and capital employed in the fisheries of the Great Lakes in 1899.

Items.	New York.		Pennsylvania.		Ohio.		Indiana.		Michigan.	
	No.	Value.	No.	Value.	No.	Value.	No.	Val.	No.	Value.
Vessels fishing	10	$34,000	25	$60,200	50	$187,200	1	$6,000	49	$153,500
Tonnage	167	.....	284	.....	796	.....	53	.....	916	.....
Outfit	.....	7,070	.....	20,485	.....	43,326	.....	450	.....	35,345
Vessels transporting	2	1,000	1	1,000	16	63,500	.....	.....	5	14,450
Tonnage	22	.....	16	.....	351	.....	.....	.....	150	.....
Outfit	.....	90	.....	150	.....	9,630	.....	.....	.....	3,796
Boats	421	18,437	49	8,055	630	57,797	34	1,195	1,447	91,969
Apparatus—vessel fisheries:										
Pound nets	.....	.....	.....	.....	.....	.....	.....	.....	45	2,565
Gill nets	2,995	17,133	9,024	51,962	16,999	91,775	750	5,250	20,203	153,236
Lines	.....	.....	.....	.....	.....	.....	.....	.....	.....	70
Apparatus—shore fisheries:										
Pound nets and trap nets	169	6,885	152	23,610	1,245	269,875	15	4,675	1,809	253,478
Gill nets	4,471	40,709	2,340	14,130	7,036	32,147	135	725	14,458	99,772
Seines	28	820	.....	.....	92	7,425	.....	.....	42	3,053
Fyke nets	451	5,412	.....	.....	555	15,130	.....	.....	535	9,242
Lines	.....	3,975	.....	90	.....	760	.....	144	.....	2,237
Other apparatus	.....	427	.....	.....	.....	142	.....	.....	.....	807
Shore and accessory property	.....	146,585	.....	171,420	.....	734,115	.....	9,775	.....	340,928
Cash capital	.....	119,200	.....	105,000	.....	359,700	.....	5,000	.....	123,000
Total	.....	401,743	.....	456,102	.....	1,872,522	.....	33,214	.....	1,287,448

Items.	Illinois.		Wisconsin.		Minnesota.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	4	$10,500	40	$121,600	.....	.....	179	$573,000
Tonnage	58	.....	603	.....	.....	.....	2,877	.....
Outfit	.....	1,935	.....	19,184	.....	.....	.....	127,795
Vessels transporting	.....	.....	5	6,700	.....	.....	29	86,650
Tonnage	.....	.....	125	.....	.....	.....	664	.....
Outfit	.....	.....	.....	1,510	.....	.....	.....	15,176
Boats	37	2,145	572	40,238	91	$7,930	3,281	227,766
Apparatus—vessel fisheries:								
Pound nets	.....	.....	.....	.....	.....	.....	45	2,565
Gill nets	1,369	8,780	12,157	105,680	.....	.....	63,497	433,816
Lines	.....	.....	.....	410	.....	.....	.....	480
Apparatus—shore fisheries:								
Pound nets and trap nets	5	1,385	391	96,935	6	1,000	3,792	657,843
Gill nets	713	3,210	12,262	51,335	775	14,674	42,190	256,702
Seines	.....	.....	.....	.....	.....	.....	162	11,298
Fyke nets	12	180	1,405	22,607	.....	.....	2,958	52,571
Lines	.....	296	.....	1,424	.....	155	.....	9,081
Other apparatus	.....	1,710	.....	784	.....	.....	.....	3,870
Shore and accessory property	.....	693,700	.....	91,732	.....	37,248	.....	2,225,503
Cash capital	.....	1,147,500	.....	59,200	.....	15,000	.....	1,933,600
Total	.....	1,871,341	.....	619,339	.....	76,007	.....	6,617,716

Table showing, by States, the products of the fisheries of the Great Lakes in 1899.

Species.	New York.		Pennsylvania.		Ohio.		Indiana.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	58,625	$3,955	38,299	$3,031	83,714	$5,933	250	$18
Cat-fish and bullheads	654,666	22,921	100,727	3,022	704,029	21,503	.....	.....
Crappie	.....	.....	60,000	1,800	.....	.....	.....	.....
Eels	124,040	6,177	.....	.....	99	8	84	6
Fresh-water drum	10,130	102	57,993	580	1,043,818	6,792	33,227	521
German carp	10,505	240	12,195	244	3,417,094	47,176	1,715	24
Herring, fresh	3,382,736	46,343	10,742,315	134,142	19,345,986	252,802	271,755	7,221
Herring, salted	25,600	1,024	.....	.....	.....	.....	.....	.....
Ling or lawyers	.....	.....	.....	.....	.....	.....	2,062	21
Mooneye	.....	.....	.....	.....	43,836	867	.....	.....
Pike and pickerel	100,365	5,861	8,687	693	739	38	356	29
Pike perch (wall-eyed)	32,688	2,052	67,354	3,048	1,195,705	57,323	.....	.....
Pike perch (blue pike)	995,877	39,950	1,522,939	44,520	2,212,966	64,270	.....	.....
Pike perch (sauger)	9,115	633	11,110	327	2,962,096	73,363	.....	.....
Rock bass	102,968	2,323	.....	.....	5,296	91	.....	.....
Sturgeon	816,588	58,707	99,570	7,090	50,094	4,519	17,647	831
Suckers, fresh	372,108	6,169	120,245	1,339	1,171,782	12,920	12,534	189
Sun-fish	148,449	2,099	125,000	* 3,750	36,800	407	.....	.....
Trout, fresh	44,674	2,363	722	61	2,060	165	35,012	2,027
White bass	47,732	1,000	454,434	8,639	1,055,951	20,046	620	25
White-fish, fresh	334,391	21,885	615,821	46,690	1,049,578	76,276	10,358	648
Yellow perch	664,949	16,213	815,553	16,911	2,174,564	30,310	207,270	4,930
Other fish	22,700	1,593	.....	.....	.....	.....	.....	.....
Frogs	1,750	306	.....	.....	982	172	.....	.....
Turtles	.....	.....	.....	.....	67,211	2,324	.....	.....
Total	7,960,656	241,916	14,852,964	275,887	36,624,400	677,305	592,890	16,490

Species.	Illinois.		Michigan.		Wisconsin.		Minnesota.		Total.	
	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.
Black bass	.....	.....	11,973	$872	3,355	$244	.....	.....	196,216	$14,053
Cat-fish and bullheads	.....	.....	661,314	19,402	62,064	1,679	.....	.....	2,182,800	68,527
Crappie	.....	.....	.....	.....	.....	.....	.....	.....	60,000	1,800
Eels	300	$24	1,511	98	.....	.....	.....	.....	126,034	6,313
Fresh-water drum	.....	.....	235,022	1,518	.....	.....	.....	.....	1,380,190	9,513
German carp	3,150	110	218,082	4,336	11,605	232	.....	.....	3,674,346	52,362
Herring, fresh	354,805	9,903	4,168,090	77,666	7,283,218	143,089	125,698	$2,094	45,674,603	673,260
Herring, salted	.....	.....	8,817,513	170,091	5,183,950	92,454	211,910	4,238	14,238,973	267,807
Ling or lawyers	34,356	344	21,601	180	85,200	508	.....	.....	143,219	1,053
Mooneye	.....	.....	.....	.....	.....	.....	.....	.....	43,836	867
Pike and pickerel	.....	.....	280,681	10,589	66,196	3,488	.....	.....	457,024	20,698
Pike perch (wall-eyed)	.....	.....	1,944,648	90,797	71,497	3,283	.....	.....	3,311,892	156,503
Pike perch (blue pike)	.....	.....	.....	.....	.....	.....	.....	.....	4,731,782	148,740
Pike perch (sauger)	.....	.....	44,244	990	.....	.....	.....	.....	3,026,565	75,313
Rock bass	.....	.....	88,139	1,862	4,000	38	.....	.....	200,403	4,314
Sturgeon	.....	.....	130,844	9,209	14,605	729	.....	.....	*1,129,348	81,085
Suckers, fresh	41,055	564	1,551,905	26,001	532,227	5,023	.....	.....	3,801,856	52,205
Suckers, salted	.....	.....	223,531	3,523	18,600	340	.....	.....	242,131	3,863
Sun-fish	.....	.....	74,952	948	.....	.....	.....	.....	385,201	7,204
Trout, fresh	76,528	4,503	6,319,147	246,396	3,420,309	151,614	170,278	5,008	10,068,730	412,137
Trout, salted	.....	.....	372,280	13,878	93,561	3,024	77,017	2,237	542,858	19,139
White bass	.....	.....	40,867	1,020	3,600	111	.....	.....	1,603,204	30,841
White-fish, fresh	200	10	2,817,740	138,380	102,621	5,206	6,422	239	4,937,131	289,334
White-fish, salted	.....	.....	143,162	7,139	7,071	284	6,650	266	156,883	7,689
White-fish (blue-fin)	.....	.....	657,038	16,801	265,376	7,060	10,964	250	933,378	24,111
White-fish (Menominee) fresh	.....	.....	304,750	7,822	182,720	4,592	.....	.....	487,470	12,414
White-fish (Menominee) salted	.....	.....	92,890	2,733	75,200	2,637	.....	.....	168,090	5,370
Yellow perch	677,715	21,826	3,137,157	41,128	1,907,594	25,032	.....	.....	9,584,802	156,350
Other fish	.....	.....	1,771	161	.....	.....	.....	.....	24,471	1,754
Crawfish	.....	.....	.....	.....	135,861	3,498	.....	.....	135,861	3,498
Frogs	.....	.....	8,000	520	.....	.....	.....	.....	10,732	998
Turtles	.....	.....	.....	.....	.....	.....	.....	.....	67,211	2,324
Total	1,188,109	37,284	32,368,852	894,060	19,530,430	454,165	608,939	14,332	113,727,240	2,611,439

*Includes 47,470 pounds of caviar, valued at $30,510, apportioned among the States as follows: New York, 31,287 lbs., $20,424; Pennsylvania, 6,274 lbs., $3,992; Ohio, 3,340 lbs., $2,659; Michigan, 6,569 lbs., $3,435.

FISHERIES OF MICHIGAN.

The State of Michigan is located on Lakes Erie, St. Clair and tributaries, Huron, Michigan, and Superior. The extent of its fisheries on each of these waters is shown in the following tables:

Table showing the number of persons employed in the fisheries of Michigan in 1899.

How employed.	Lake Erie.	Lake St. Clair.*	Lake Huron.	Lake Michigan.	Lake Superior.	Total.
On fishing vessels			62	208	51	321
On transporting vessels	8		7			15
In shore fisheries	110	374	986	952	210	2,632
Shoresmen	2	68	186	170	33	459
Total	120	442	1,241	1,330	294	3,427

*Includes St. Clair and Detroit rivers.

Table showing, by lakes, the apparatus and capital employed in the fisheries of Michigan in 1899.

Items.	Lake Erie.		Lake St. Clair.*		Lake Huron.		Lake Michigan.		Lake Superior.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					9	$42,500	33	$78,200	7	$32,800
Tonnage					157		559		200	
Outfit						7,715		21,780		5,850
Vessels transporting	2	$10,200			3	4,250				
Tonnage	51				99					
Outfit		3,216				580				
Boats	63	3,659	188	$3,770	527	40,835	531	31,625	138	12,080
Apparatus—vessel fisheries:										
Pound nets					35	525	10	2,040		
Gill nets					2,266	27,720	15,464	91,152	2,473	34,364
Lines								70		
Apparatus—shore fisheries:										
Pound nets and trap nets	303	34,980	5	1,050	961	111,314	416	87,639	124	18,495
Gill nets		620	60	600	3,410	26,664	8,728	39,098	2,260	33,410
Fyke nets	62				398	7,632	60	840	15	150
Seines	8	565	13	1,255	9	673	11	510	1	50
Lines				644		346		1,140		107
Other apparatus				271		210		6		320
Shore and accessory property		17,297		26,945		148,489		88,687		59,510
Cash capital				20,000		55,500		13,500		34,000
Total		70,537		54,535		474,953		456,287		231,136

SUMMARY.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	49	$153,500	Apparatus—shore fisheries:		
Tonnage	916		Pound nets and trap nets	1,809	$253,478
Outfit		35,345	Gill nets	14,458	99,772
Vessels transporting	5	14,450	Fyke nets	535	9,242
Tonnage	150		Seines	42	3,053
Outfit		3,796	Lines		2,237
Boats	1,447	91,969	Other apparatus		807
Apparatus—vessel fisheries:			Shore and accessory property		340,928
Pound nets	45	2,565	Cash capital		123,000
Gill nets	20,203	158,236			
Lines		70	Total		1,287,448

* Includes St. Clair and Detroit rivers.

Table showing, by lakes and species, the yield of the fisheries of Michigan in 1899.

Species.	Lake Erie.		Lake St. Clair.*		Lake Huron.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	1,154	$80	200	$14	5,659	$396
Cat-fish and bullheads	61,705	1,839	17,505	629	574,406	16,627
Eels	550	39			861	49
Fresh-water drum	35,181	177	17,050	131	160,646	1,009
German carp	194,903	3,846	8,000	221	6,369	143
Herring, fresh	17,938	539			1,073,957	10,696
Herring, salted					2,625,850	49,722
Ling or lawyers					20,880	167
Pike and pickerel	10,199	510	42,365	1,795	191,751	6,995
Pike perch (wall-eyed)	449,867	24,859	268,350	11,877	1,110,516	49,294
Pike perch (sauger)	44,244	990				
Rock bass			3,700	217	83,344	1,612
Sturgeon	12,305	786	7,600	1,352	30,497	1,268
Suckers, fresh	183,337	2,750	33,600	325	980,695	18,502
Suckers, salted					126,795	1,818
Sun-fish	13,640	205	250	4	61,062	739
Trout, fresh			69,915	2,884	1,879,411	80,077
Trout, salted					7,690	346
White bass	40,707	1,010				
White-fish, fresh	228,459	18,136	69,902	3,087	584,168	31,525
White-fish, salted					8,140	385
White-fish (Menominee), fresh					112,417	2,667
White-fish (Menominee), salted					24,060	810
Yellow perch	67,447	1,013	40,000	1,202	2,740,669	32,690
Other fish	540	5	630	126	484	21
Frogs					8,000	520
Total	1,362,176	56,784	579,067	23,864	12,418,327	308,078

Species.	Lake Michigan.		Lake Superior.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	4,960	$382			11,973	$872
German carp	8,810	126			218,082	4,336
Cat-fish and bullheads	98	3	7,600	$304	661,314	19,402
Eels	100	10			1,511	98
Fresh-water drum	22,145	201			235,022	1,518
Herring, fresh	3,007,984	65,146	68,211	1,285	4,168,090	77,666
Herring, salted	6,168,963	119,840	22,700	529	8,817,513	170,091
Ling or lawyers	721	13			21,601	180
Pike and pickerel	20,764	973	15,602	316	280,681	10,589
Pike perch (wall-eyed)	103,446	4,309	12,469	458	1,944,648	90,797
Pike perch (sauger)					44,244	990
Rock bass	161	5	934	28	88,139	1,862
Sturgeon	76,057	5,628	4,385	175	130,844	9,209
Suckers, fresh	349,073	4,369	5,200	55	1,551,905	26,001
Suckers, salted	91,536	1,601	5,200	104	223,531	3,523
Sun-fish					74,952	948
Trout, fresh	2,501,112	102,098	1,868,709	61,337	6,319,147	246,396
Trout, salted	71,837	3,148	292,753	10,384	372,280	13,878
White bass	160	10			40,867	1,020
White-fish, fresh	1,348,454	64,217	586,757	21,415	2,817,740	138,380
White-fish, salted	103,222	5,467	31,800	1,287	143,162	7,139
White-fish (bluefin)	248,614	6,145	408,424	10,656	657,038	16,801
White-fish (Menominee), fresh	192,333	5,155			304,750	7,822
White-fish (Menominee), salted	68,830	1,923			92,890	2,733
Yellow perch	285,162	6,184	3,879	39	3,137,157	41,128
Other fish	117	9			1,771	161
Frogs					8,000	520
Total	14,674,659	396,962	3,334,623	108,372	32,368,852	894,060

*Includes St. Clair and Detroit rivers.

FISHERIES OF WISCONSIN.

The fisheries of Wisconsin are prosecuted in Lakes Michigan and Superior, but are much more important in the former than in the latter. Their extent on each lake is shown in the following tables:

Table showing the number of persons employed in the fisheries of Wisconsin in 1899.

How employed.	Lake Michigan.	Lake Superior.	Total.
On fishing vessels	217	16	233
On transporting vessels	10	5	15
In shore fisheries	765	141	906
Shoresmen	192	6	198
Total	1,184	168	1,352

Table showing the apparatus and capital employed in the fisheries of Wisconsin in 1899.

Items.	Lake Michigan.		Lake Superior.		Total.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	38	$115,600	2	$6,000	40	$121,600
Tonnage	544		59		603	
Outfit		16,530		2,654		19,184
Vessels transporting	4	3,700	1	3,000	5	6,700
Tonnage	107		18		125	
Outfit		210		1,300		1,510
Boats	496	33,003	76	7,235	572	40,238
Apparatus—vessel fisheries:						
Gill nets	11,357	97,680	800	8,000	12,157	105,680
Lines		410				410
Apparatus—shore fisheries:						
Pound nets and trap nets	359	90,610	32	6,325	391	96,935
Gill nets	11,341	42,500	921	8,835	12,262	51,335
Fyke nets	1,405	22,607			1,405	22,607
Lines		1,098		326		1,424
Other apparatus		784				784
Shore and accessory property		77,467		14,265		91,732
Cash capital		52,200		7,000		59,200
Total		554,399		64,940		619,339

Table showing, by lakes and species, the yield of the fisheries of Wisconsin in 1899.

Species.	Lake Michigan.		Lake Superior.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	3,355	$244			3,355	$244
Cat-fish and bullheads	62,064	1,679			62,064	1,679
German carp	11,605	232			11,605	232
Herring, fresh	6,591,109	139,514	692,109	$3,575	7,283,218	143,089
Herring, salted	5,179,100	92,405	4,850	49	5,183,950	92,454
Ling or lawyers	85,200	508			85,200	508
Pike and pickerel	66,196	3,488			66,196	3,488
Pike perch (wall-eyed)	70,287	3,246	1,210	37	71,497	3,283
Rock bass	4,000	38			4,000	38
Sturgeon	14,575	728	30	1	14,605	729
Suckers, fresh	531,980	5,021	247	2	532,227	5,023
Suckers, salted	17,600	330	1,000	10	18,600	340
Trout, fresh	2,794,458	132,387	625,851	19,227	3,420,309	151,614
Trout, salted	10,000	518	83,561	2,506	93,561	3,024
White bass	3,600	111			3,600	111
White-fish, fresh	48,130	3,150	54,491	2,056	102,621	5,206
White-fish, salted			7,071	284	7,071	284
White-fish (bluefin)	249,704	6,649	15,672	411	265,376	7,060
White-fish (Menominee), fresh	182,720	4,592			182,720	4,592
White-fish (Menominee), salted	75,200	2,637			75,200	2,637
Yellow perch	1,907,594	25,032			1,907,594	25,032
Crawfish	135,861	3,498			135,861	3,498
Total	18,044,338	426,007	1,486,092	28,158	19,530,430	454,165

FISHERIES OF NEW YORK.

The fishery interests of New York in the Great Lakes region embrace the fisheries of Lake Ontario, including the St. Lawrence and Niagara rivers, and also those of two counties in that State, Erie and Chautauqua, located on Lake Erie. The yield from Lake Erie was 5,554,324 pounds, valued at $140,919, and from Lake Ontario 2,406,332 pounds, valued at $100,997.

Table showing the number of persons employed in the fisheries of New York in 1899.

How employed.	*Lake Ontario.	Lake Erie.	Total.
On fishing vessels	.....	55	55
On transporting vessels	5	.....	5
In shore fisheries	373	817	1,190
Shoresmen	13	104	117
Total	391	976	1,367

Table showing the apparatus and capital employed in the fisheries of New York in 1899.

Items.	*Lake Ontario.		Lake Erie.		Total.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	.....	.....	10	$34,000	10	$34,000
Tonnage	.....	.....	167	.....	167	.....
Outfit	.....	.....	.....	7,070	.....	7,070
Vessels transporting	2	$1,000	.....	.....	2	1,000
Tonnage	22	.....	.....	.....	22	.....
Outfit	.....	90	.....	.....	.....	90
Boats	287	8,482	134	9,955	421	18,437
Apparatus—vessel fisheries:						
Gill nets	.....	.....	2,995	17,133	2,995	17,133
Apparatus—shore fisheries:						
Pound nets and trap nets	145	5,850	24	1,035	169	6,885
Gill nets	1,187	18,674	3,284	22,035	4,471	40,709
Fyke nets	451	5,412	.....	.....	451	5,412
Seines	24	420	4	400	28	820
Lines	.....	1,355	.....	2,620	.....	3,975
Other apparatus	.....	427	.....	.....	.....	427
Shore and accessory property	.....	18,440	.....	128,145	.....	146,585
Cash capital	.....	20,200	.....	99,000	.....	119,200
Total	.....	80,350	.....	321,393	.....	401,743

Table showing, by lakes and species, the yield of the fisheries of New York in 1899.

Species.	*Lake Ontario.		Lake Erie.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	48,046	$3,133	10,579	$822	58,625	$3,955
Cat-fish and bullheads	518,423	18,834	136,243	4,087	654,666	22,921
Eels	123,840	6,163	200	14	124,040	6,177
Fresh-water drum	.....	.....	10,130	102	10,130	102
German carp	1,000	50	9,505	190	10,505	240
Herring, fresh	61,178	2,789	3,321,558	43,554	3,382,736	46,343
Herring, salted	25,600	1,024	.....	.....	25,600	1,024
Pike and pickerel	100,365	5,861	.....	.....	100,365	5,861
Pike perch (wall-eyed)	10,440	827	22,248	1,225	32,688	2,052
Pike perch (blue pike)	186,996	9,439	808,881	30,511	995,877	39,950
Pike perch (sauger)	.....	.....	9,115	633	9,115	633
Rock bass	102,968	2,323	.....	.....	102,968	2,323
Sturgeon	*189,155	17,710	627,433	40,997	816,588	58,707
Suckers	278,738	5,101	93,370	1,068	372,108	6,169
Sun-fish	148,449	2,099	.....	.....	148,449	2,099
Trout	15,432	853	29,242	1,510	44,674	2,363
White bass	2,300	92	45,432	908	47,732	1,000
White-fish	161,935	10,978	172,456	10,907	334,391	21,885
Yellow perch	407,017	11,822	257,932	4,391	664,949	16,213
Other fish	22,700	1,593	.....	.....	22,700	1,593
Frogs	1,750	306	.....	.....	1,750	306
Total	2,406,332	100,997	5,554,324	140,919	7,960,656	241,916

*Includes St. Lawrence and Niagara rivers.

STATISTICS

OF THE

FISHERIES OF THE MISSISSIPPI RIVER AND TRIBUTARIES.

PREPARED IN THE DIVISION OF STATISTICS AND METHODS OF THE FISHERIES, UNITED STATES FISH COMMISSION.

C. H. TOWNSEND, Assistant in Charge.

INTRODUCTORY NOTE.

The accompanying report of the fisheries of the Mississippi River and tributaries for the year 1899 is the result of a canvass made by the statistical agents of this Commission. These fisheries were previously canvassed in 1895, in connection with an investigation of the interior waters of the United States, exclusive of the Great Lakes and coastal rivers, for the year 1894.

The present inquiries were conducted during the summer of 1900 as follows: Mr. John N. Cobb investigated the fisheries of the Ohio River and the Mississippi and tributaries from Alton, Ill., to New Orleans, being assisted in Arkansas and Louisiana by Mr. G. H. H. Moore. Mr. W. A. Roberts canvassed the Mississippi above Dubuque, Iowa; Mr. C. H. Stevenson, the Mississippi from Dubuque to Keokuk, Iowa, and the Missouri and its tributaries; Mr. E. S. King, the Illinois River and tributaries and the Mississippi between Keokuk, Iowa, and Alton, Ill. Inquiries respecting the Tennessee River were made by Mr. John B. Wilson.

Upon the completion of the field inquiries the general results were made public in Statistical Bulletin No. 107, which was distributed throughout the Mississippi Valley.

In the report of the Commissioner for the year ending June 30, 1901, the results were given in less condensed form. In the present report the information collected is presented in detail. This report has been prepared under the direction of Mr. C. H. Townsend, assistant in charge of the Division of Fisheries. The field agents have assisted in the compilation of the data in the office, and most of them have contributed brief notes on the fisheries.

The assistant in charge has had the constant aid of Mr. Ansley Hall and other persons in the office, especially commending the painstaking assistance of Mr. Hall.

GEO. M. BOWERS, *Commissioner.*

STATISTICS OF THE FISHERIES OF THE MISSISSIPPI RIVER AND TRIBUTARIES.

GENERAL NOTES AND STATISTICS.

The Mississippi River and tributaries constitute the most extensive river system in the United States and embrace many large rivers which are of great value as navigable waterways and also on account of their fisheries. Among the more important of these, aside from the Mississippi itself, are the Missouri, Illinois, Ohio, Wabash, Cumberland, Tennessee, St. Francis, Yazoo, Red, and White rivers. There are also numerous other rivers, some of which are navigable, and small lakes tributary to the Mississippi and its affluents which have considerable value for fishing purposes. The fisheries of this river system are prosecuted in 17 States, the area of which aggregates 928,665 square miles and the population 34,792,662. The number of persons employed in these fisheries in 1899 was 11,155. Of this number, 8,566 were fishermen and 2,589 were shoresmen in the various branches of industry related to the fisheries.

The States having the largest number of persons, including shoresmen, engaged in the fisheries of these waters, were: Iowa, 2,637; Illinois, 2,389; Missouri, 1,531, and Kentucky, 589. In the remainder of the States the number varied from 68 in Alabama to 567 in Wisconsin.

The fisheries of greatest prominence were the seine fishery, employing 2,782 fishermen; the fyke-net fishery, 3,310; the set-line fishery, 3,368, and the mussel fishery, with crowfoot lines, rakes, etc., 1,442. In many instances, however, the same persons were employed in more than one fishery.

The amount of capital invested in the fisheries, including the value of boats, apparatus of capture, shore and accessory property, and the cash or working capital employed in the various fishery industries, was $1,782,825. Boats, the number of which was 7,863, represented $167,018; fishing apparatus, $303,262; shore and accessory property, $719,095, and cash capital, $593,450.

The forms of apparatus having the widest distribution are seines, fyke nets, and lines. The number of seines used was 1,007, the length of which was 179,194 yards and the value $71,641. The largest number in any single State was 303, valued at $27,780, in Illinois. In Missouri, also, there were 154 valued at $8,010, and in Iowa 145 valued at $8,130; but in each of the other States they were employed less

extensively. Fyke nets are more numerous and valuable than any other apparatus, the number used being 35,036, valued at $180,514. They were employed extensively in nearly all the States, but those in which the largest numbers occurred were Illinois, 13,614, valued at $65,164; Iowa, 4,056, valued at $16,647; Missouri, 4,027, valued at $16,850; Arkansas, 2,576, valued at $13,813; Kentucky, 2,462, valued at $14,334; Tennessee, 2,336, valued at $18,955, and Mississippi, 2,065, valued at $11,715. More fyke nets are employed in this region than in all other sections of the country combined.

Lines were also important as a means of capture. The number of set lines used was 13,642, valued at $13,666, and of hand and other lines 4,045, valued at $2,014. The set lines are similar in construction to the trawl lines in the fisheries of the New England States, but are much less expensive. They are employed in the fisheries of all the States in this region. Next in importance in the capture of fish proper were trammel nets, the number fished being 567, with a length of 51,155 yards and a value of $13,079. While these nets are found in all the States except Alabama, Indiana, Ohio, and West Virginia, they are more numerous in Arkansas, Illinois, Iowa, and Missouri. Pound nets and gill nets are used to a limited extent, but apparently are not well adapted to river fisheries.

Of various other forms of apparatus the crowfoot lines, or dredges, and rakes used in the mussel fishery are the most valuable and productive. The "crowfoot" dredge, so called probably on account of the shape of the hooks used, generally consists of a round iron bar or a hollow iron pipe one-half to three-fourths of an inch in diameter and varying in length from 6 to 12 or 15 feet, with lines attached to it at intervals of about 6 inches, each of which contains from 4 to 6 four-pronged hooks. The hooks, which are about 4 inches long, are made of two pieces of wire so fastened together that the prongs are at right angles to each other. The method of arranging the hooks is to place them at even distances apart from within a few inches of the bar to the end of the line. At or near each end of the bar is attached a rope, the two parts of which come together, forming a bridle. To this is fastened another rope, by which the apparatus is drawn along the bottom of the river in a manner similar to that of operating an ordinary oyster dredge. The number of hooks to each bar depends upon the length of the bar, the number of lines, and the number of hooks on each line. This device, which first came into use in 1897, has in recent years become the principal apparatus employed in the capture of mussels. Its effectiveness depends on the fact that the position of the mussel when feeding is with its shell opened against the current. As the boat operating crowfoot lines drifts downstream the prongs of the hooks enter the open shell of the mussels. The valves then close and the mussels remain on the hooks until they are detached, after the

dredge is drawn into the boat. The rakes above referred to are of several varieties, but the kind most commonly used is the shoulder rake. The apparatus of various forms employed in this fishery was valued at $10,393.

The investment in shore and accessory property and cash capital, utilized chiefly in the pearl-button industry and wholesale trade in fishery products, was distributed in a number of States. Those in which it was largest were Missouri, $593,804; Iowa, $291,492; Nebraska, $119,550; Illinois, $67,480; Minnesota, $79,420; Tennessee, $62,257; Kentucky, $57,702, and Wisconsin, $23,275.

The products of the fisheries of the Mississippi and its tributaries in 1899 had a total weight of 96,797,437 pounds and a value of $1,781,029. Of this quantity, fish, including caviar, represented 47,719,798 pounds, $1,473,040; shrimp, 200,058 pounds, $16,095; turtles and terrapin, 782,015 pounds, $17,148; frogs, 440,996 pounds, $53,054; alligator hides, 990, $1,238; otter skins, 810, $4,050, and mussel shells, 23,824 tons, $216,404.

The species taken in greatest quantity were buffalo-fish, 14,215,975 pounds, $349,913; German carp, 11,868,840 pounds, $289,258; cat-fish, 7,648,179 pounds, $339,800; fresh-water drum, 3,149,232 pounds, $108,786; paddle-fish or spoonbill cat, 2,473,250 pounds, $55,514; suckers, 2,243,934 pounds, $76,993; crappie, 1,318,832 pounds, $61,400. The greater part of the German carp, or 9,896,499 pounds, valued at $244,322, was the product of the fisheries of Illinois; buffalo-fish were also more abundant in that State than in any other, the catch being 4,050,941 pounds, valued at $111,707.

Paddle-fish were taken in twelve States and in practically all of the principal rivers of this region. The catch, over half of which was obtained in Arkansas and Mississippi, is more than twice as large as in 1894, the year for which these fisheries were last canvassed. Formerly only the flesh of this fish was marketed, but in about 1896 the fishermen along the lower part of the Mississippi River began to use the roe in the preparation of caviar. In 1899 caviar from the roe of paddle-fish was prepared in three States. Arkansas produced 34,175 pounds, $11,488; Louisiana, 3,750 pounds, $1,000, and Mississippi 32,775 pounds, $14,391, the total yield being 70,700 pounds, $26,879. It is said to be less desirable in flavor than the caviar made from the roe of sturgeon, and is marketable chiefly because sturgeon caviar has become scarce and expensive. The product is shipped for market to New York and Chicago.

Other species taken in considerable quantities were black bass, 948,184 pounds, $56,652; sun-fish, 910,963 pounds, $21,318; shovel-nose sturgeon, 711,693 pounds, $19,142; white and rock bass, 278,457 pounds, $11,494; lake sturgeon (*Acipenser rubicundus*), 234,145 pounds, $8,064; pike and pickerel, 216,952 pounds, $8,045; and pike perch (wall-eyed), 210,112 pounds, $12,156.

A newly described species of fish, which has recently been identified as Ohio shad (*Alosa ohiensis*), is reported in the present statistics of this region. The catch was taken in the Ohio River in West Virginia, Indiana, and Kentucky, and aggregated 6,955 pounds, valued at $355. The greater part of this quantity was obtained with seines in the vicinity of Louisville, Ky. A few were also secured in fyke nets and gill nets. It is probable that this species has been taken to some extent in these waters for a number of years.

In the yield of the fisheries of this region the leading States are Illinois and Iowa, the former being credited with 28,479,807 pounds of products, valued at $579,168, and the latter with 23,901,922 pounds, valued at $207,801. Wisconsin ranks next in the quantity of products, having 17,236,735 pounds, valued at $88,139. The fishery products of Missouri amounted to 7,551,442 pounds, worth $211,301, and those of Arkansas to 4,896,591 pounds, worth $168,071, the value of the products in each of these two States being about twice that of Wisconsin. In Illinois, Iowa, Missouri, and Wisconsin, the States leading in the quantity of products, the yield consists largely of mussel shells, which are utilized in the pearl-button industry. Other States yielding over 1,000,000 pounds of products were Tennessee, 2,774,560 pounds, valued at $87,537; Mississippi, 3,920,942 pounds, valued at $97,711; Minnesota, 1,322,171 pounds, valued at $40,258; Louisiana, 1,942,185 pounds, valued at $57,072, and Kentucky, 1,753,278 pounds, valued at $78,899. In each of the other States participating in the fisheries of the Mississippi and its tributaries the quantity of products was considerably less than a million pounds.

The principal items in the fisheries of Illinois were German carp, 9,896,499 pounds, worth $244,322; buffalo-fish, 4,050,941 pounds, worth $111,707; mussel shells, 8,910,000 pounds, worth $43,468, and cat-fish, 1,569,615 pounds, worth $68,535. In Iowa the yield of mussel shells, the most important item in the fisheries, amounted to 20,354,000 pounds, valued at $97,449, and of German carp, which was next in importance, 1,039,375 pounds, valued at $22,518. In Mississippi more than half of the catch, or 2,023,230 pounds, valued at $33,747, consisted of buffalo-fish, and in Arkansas nearly half the catch, or 2,388,890 pounds, worth $52,521, was comprised of that species. In Missouri the catch of buffalo-fish was 1,862,226 pounds, valued at $44,743, and of mussel shells, 2,084,000 pounds, worth $9,217. In Wisconsin the yield of mussel shells was 16,260,000 pounds, worth $66,110. In the remaining States of this region the yield of any one species was less than a million pounds. Cat-fish constituted a considerable part of the catch in certain States, as follows: Arkansas, 838,514 pounds, worth $42,044; Iowa, 750,678 pounds, worth $37,845; Missouri, 875,050 pounds, worth $40,755; Tennessee, 708,260 pounds, worth $24,289; and Louisiana, 682,347 pounds, worth $22,373. In Missouri the yield of German carp was 453,250 pounds, worth $9,447. Turtles and terrapin were im-

portant products in the fisheries of Illinois, the quantity taken being 681,679 pounds, worth $14,520. The yield of paddle-fish, or spoonbill cat, in Mississippi was 948,305 pounds, worth $16,739, and in Arkansas, 551,405 pounds, worth $11,967. The caviar prepared from the roe of this species in the former State amounted to 32,775 pounds, worth $14,391, and in the latter 34,175 pounds, worth $11,488.

The following tables exhibit by States the number of persons employed, the number and value of boats and apparatus of capture, the value of shore and accessory property and the amount of cash capital, and the quantity and value of the products of the fisheries of the Mississippi River and tributaries in 1899:

Table showing, by States, the number of persons employed in the fisheries of the Mississippi River and tributaries in 1899.

States.	Fisheries.											Shoresmen.	Total, exclusive of duplication.
	Seine.	Trammel net.	Gill net.	Fyke net.	Pound net.	Cast net.	Dip net.	Set line.	Hand and drift line.	Crowfoot line or grapple.	All others.		
Alabama				60				62			6		68
Arkansas	181	80		264	24			229	39		210	32	463
Illinois	922	250	24	939	8			638	46	322	243	354	2,389
Indiana	159			190				327			8		409
Iowa	348	146		258	9				4	674		1,476	2,637
Kansas	18	11		65				74					118
Kentucky	151	14		301		4	8	363	31			38	589
Louisiana	51	4		122		25		203			96	2	326
Minnesota	83	10	2	39	23		8	35	179	5	183	48	506
Mississippi	136	12		182	3			185	22		147	51	540
Missouri	382	116		406	8			476	148	121	551	406	1,531
Nebraska	85	12		41				87				54	196
Ohio	70		2	90				143			12		182
South Dakota	24	5		24				46					72
Tennessee	33	59		240				340			115	52	476
West Virginia	50		1	43				61					86
Wisconsin	89	6		46				99		320	275	76	567
Total	2,782	725	29	3,310	75	29	16	3,368	469	1,442	1,846	2,589	11,155

Table showing, by States, the boats, apparatus, and capital used in the fisheries of the Mississippi River and tributaries in 1899.

States.	Boats.		Seines.			Trammel nets.		
	No.	Value.	No.	Length (yards).	Value.	No.	Length (yards).	Value.
Alabama	109	$1,074						
Arkansas	437	10,357	48	13,105	$6,262	102	6,730	$1,897
Illinois	1,717	54,808	303	78,826	27,780	153	17,520	3,795
Indiana	422	6,752	71	7,417	3,150			
Iowa	1,188	17,066	145	21,524	8,130	82	7,757	1,914
Kansas	118	1,287	8	785	278	6	490	160
Kentucky	572	10,460	72	7,050	2,965	7	700	160
Louisiana	347	9,684	13	2,880	1,540	2	240	60
Minnesota	263	3,005	26	5,360	1,690	9	610	156
Mississippi	412	14,120	31	9,875	4,945	6	600	170
Missouri	1,001	18,253	154	18,845	8,010	150	12,363	3,508
Nebraska	145	1,429	41	2,315	948	10	555	193
Ohio	160	2,755	30	1,255	1,200			
South Dakota	73	649	10	860	333	4	190	54
Tennessee	398	7,068	8	2,845	1,560	31	3,100	927
West Virginia	64	1,228	18	672	680			
Wisconsin	437	7,023	29	5,580	2,170	5	300	85
Total	7,863	167,018	1,007	179,194	71,641	567	51,155	13,079

Table showing, by States, the boats, apparatus, and capital used in the fisheries of the Mississippi River and tributaries in 1899—Continued.

States.	Gill nets.			Hand and other lines.		Fyke nets.		Pound nets.	
	No.	Length (yards).	Value.	No.	Value.	No.	Value.	No.	Value.
Alabama						526	$2,233		
Arkansas				196	$61	2,576	13,813	16	$775
Illinois	12	2,400	$240	742	95	13,614	65,164	6	290
Indiana						1,458	7,887		
Iowa					7	4,056	16,647	40	655
Kansas						282	1,389		
Kentucky				1,620	1,257	2,462	14,334		
Louisiana						740	3,669		
Minnesota	4	165	30		317	77	1,290	14	1,630
Mississippi				640	32	2,065	11,715	1	50
Missouri				802	197	4,027	16,850	10	1,000
Nebraska						130	532		
Ohio	1	55	10			281	2,270		
South Dakota						86	323		
Tennessee				45	48	2,336	18,955		
West Virginia	1	30	5			138	1,382		
Wisconsin						182	2,061		
Total	18	2,650	285	4,045	2,014	35,036	180,514	87	4,400

States.	Set lines.		Spears.		Small traps.		Other apparatus.	Shore and accessory property.	Cash capital.	Total investment.
	No.	Value.	No.	Value.	No.	Value.				
Alabama	540	$451			47	$705				$4,463
Arkansas	1,252	1,153	90	$65	2,197	551	$570	$3,601		39,105
Illinois	2,837	2,471			829	869	2,332	46,430	$21,050	225,324
Indiana	1,324	1,104	8	10				828		19,731
Iowa	972	999					4,759	189,242	102,250	341,669
Kansas	101	205						517		3,836
Kentucky	453	381					27	22,202	35,500	87,286
Louisiana	933	1,082			2,012	615	360	1,735		18,745
Minnesota	38	78	93	139			41	42,420	37,000	87,796
Mississippi	1,218	1,531			2,840	554		6,054	4,200	43,371
Missouri	1,552	1,302	274	438	2,628	657	1,652	325,354	268,450	645,671
Nebraska	145	232						49,050	70,500	122,884
Ohio	346	439						190		6,864
South Dakota	79	77						345		1,781
Tennessee	1,590	1,791	32	112	600	150	15	20,257	42,000	92,883
West Virginia	157	201						95		3,591
Wisconsin	105	169	45	167			2,975	10,775	12,500	37,825
Total	13,642	13,666	542	831	11,153	4,101	12,731	719,095	593,450	1,782,825

Table showing, by States, the yield of the fisheries of the Mississippi River and tributaries in 1899.

States.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alabama	10,240	$512	73,380	$3,669			233,580	$11,691
Arkansas	185,345	9,994	2,388,890	52,521	25,428	$615	838,514	42,044
Illinois	126,180	10,842	4,050,941	111,707	9,896,499	244,322	1,569,615	68,535
Indiana	7,451	705	141,515	7,677	31,401	2,268	287,817	17,572
Iowa	24,457	1,746	937,076	26,559	1,039,375	22,518	750,678	37,845
Kansas	660	54	51,995	2,225			94,960	6,137
Kentucky	14,864	1,026	471,643	17,900	78,031	3,096	415,934	20,806
Louisiana	22,735	1,428	799,320	15,655	2,645	245	682,347	22,373
Minnesota			177,400	3,991	59,100	896	254,395	6,833
Mississippi	12,878	760	2,023,230	33,747	10,825	194	397,300	14,302
Missouri	394,336	20,362	1,862,226	44,743	453,250	9,447	875,050	40,755
Nebraska	650	65	138,162	4,862			84,970	6,068
Ohio	1,466	166	4,547	386	9,332	606	110,396	5,547
South Dakota			47,290	1,812			64,368	4,184
Tennessee	142,352	8,671	862,390	18,723	86,954	1,875	708,260	24,289
West Virginia	855	112	2,160	196	6,410	490	58,600	3,120
Wisconsin	3,715	209	183,810	3,540	169,590	2,686	221,395	7,699
Total	948,184	56,652	14,215,975	349,913	11,868,840	289,258	7,648,179	339,800

Table showing, by States, the yield of the fisheries of the Mississippi River and tributaries in 1899—Continued.

States.	Crappie.		Drum, fresh-water.		Eels.		Mooneye.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alabama			224,060	$11,153	8,040	$403		
Arkansas	232,204	$12,590	304,105	7,848	3,702	106		
Illinois	356,320	14,419	610,205	17,729	29,263	1,604	2,500	$89
Indiana	4,124	276	192,743	10,631	5,078	424	4,215	172
Iowa	37,110	1,476	315,635	7,642	10,943	847		
Kansas	100	8	7,945	318	1,070	94		
Kentucky	6,867	495	390,909	18,715	3,900	170	6,396	307
Louisiana	42,900	2,826	150,795	3,602	1,670	53		
Minnesota	65,735	2,632	56,410	766	900	62		
Mississippi	41,965	2,290	198,290	3,130	3,930	68		
Missouri	358,913	18,310	197,365	6,141	7,811	269	4,195	135
Nebraska	400	28	15,080	440	300	25		
Ohio	15	1	60,077	5,334	618	63	60	3
South Dakota			300	12				
Tennessee	163,479	5,756	310,890	11,356	14,180	448		
West Virginia	100	12	28,148	2,833	755	83		
Wisconsin	8,600	281	86,275	1,136	1,745	84		
Total	1,318,832	61,400	3,149,232	108,786	93,905	4,803	17,366	706

States.	Paddle-fish.		Pike and pickerel.		Pike perch (wall-eyed).		Pike perch (sauger).	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alabama					7,800	$391		
Arkansas	551,405	$11,967	8,619	$293	4,468	347		
Illinois	195,174	6,210	22,586	1,387	28,880	1,774		
Indiana	34,125	1,308			8,930	837	200	$10
Iowa	36,390	1,128	30,322	1,370	24,137	1,291	7,850	310
Kansas	7,850	265	325	26				
Kentucky	147,260	4,919			5,988	532	2,130	113
Louisiana	132,200	1,960	300	18	50	3		
Minnesota			113,760	3,225	87,485	4,032	19,810	718
Mississippi	948,305	16,739	350	25	1,216	77		
Missouri	190,931	5,865	19,300	701	17,833	1,087		
Nebraska	16,375	444	3,000	218	800	48		
Ohio					3,674	392	2,498	260
South Dakota	2,050	52	4,825	330				
Tennessee	211,185	4,657			9,517	746	463	41
West Virginia			30	5	2,554	294	1,412	173
Wisconsin			13,535	447	6,780	305	4,960	174
Total	2,473,250	55,514	216,952	8,045	210,112	12,156	39,323	1,799

States.	Shad.		Sturgeon, lake.		Sturgeon, shovel-nose.		Suckers.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alabama			4,480	$224	7,600	$380	124,800	$6,241
Arkansas					15,305	453	83,075	1,299
Illinois			34,809	1,279	124,843	2,625	259,204	7,845
Indiana	280	$19	3,705	131	39,489	1,938	155,859	8,768
Iowa			36,768	1,184	7,010	188	188,591	3,836
Kansas			1,800	78			111,215	4,341
Kentucky	6,550	330	4,519	244	35,616	1,391	131,093	7,081
Louisiana							28,550	455
Minnesota			83,035	2,152	146,415	2,639	86,185	1,490
Mississippi					8,600	100	105,760	1,687
Missouri			9,219	309	150,530	4,511	495,307	14,181
Nebraska			16,650	694			88,630	2,967
Ohio			835	86	2,739	275	74,416	5,452
South Dakota			420	15	400	16	16,240	520
Tennessee			10,580	704	32,398	1,466	147,689	5,266
West Virginia	125	6	2,070	217	1,968	201	55,150	4,227
Wisconsin			25,255	747	138,780	2,959	92,170	1,337
Total	6,955	355	234,145	8,064	711,693	19,142	2,243,934	76,993

Table showing, by States, the yield of the fisheries of the Mississippi River and tributaries in 1899—Continued.

States.	Sun-fish.		White and rock bass.		Yellow perch.		Other fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alabama							158,480	$7,924
Arkansas	102,430	$3,025	21,776	$1,210				
Illinois	543,387	12,067	166,591	5,601	19,939	$556	820,160	8,829
Indiana	8,593	747	5,453	488	14,202	780	250	18
Iowa	55,275	1,283	11,585	434	9,965	253	6,930	56
Kentucky	2,735	142	3,960	299	13,800	925	250	20
Louisiana			14,065	899				
Minnesota	18,465	499	14,347	423	4,375	67	2,100	64
Mississippi			14,770	728				
Missouri	131,520	2,128	17,025	911			450	7
Nebraska			1,300	66	300	12		
Ohio	390	27	455	46				
Tennessee	36,668	1,117	2,075	173	705	44	6,575	358
West Virginia	165	54	585	70				
Wisconsin	11,335	229	4,470	146	1,720	29	2,600	21
Total	910,963	21,318	278,457	11,494	65,006	2,666	997,795	17,297

States.	Shrimp.		Turtles and terrapin.		Frogs.		Caviar.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Arkansas	7,200	$600	9,690	$259	79,760	$10,162	34,175	$11,488
Illinois			681,679	14,520	31,032	3,760		
Indiana			5,354	242				
Iowa			17,825	386				
Kentucky			10,833	388				
Louisiana	52,980	4,395	2,580	52			3,750	1,000
Minnesota					92,254	9,609		
Mississippi	119,838	9,430	900	18			32,775	14,391
Missouri			43,819	1,004	237,600	29,313		
Ohio			975	83	350	210		
Tennessee	20,040	1,670	8,160	177				
West Virginia			200	19				
Total	200,058	16,095	782,015	17,148	440,996	53,054	70,700	26,879

States.	Alligator hides.		Otter skins.		Mussel shells.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alabama							852,460	$42,588
Arkansas			500	$1,250			4,896,591	168,071
Illinois					8,910,000	$43,468	28,479,807	579,168
Indiana							950,784	55,011
Iowa					20,354,000	97,449	23,901,922	207,801
Kansas							277,920	13,546
Kentucky							1,753,278	78,899
Louisiana	4,950	$1,238	348	870			1,942,185	57,072
Minnesota					40,000	160	1,322,171	40,258
Mississippi			10	25			3,920,942	97,711
Missouri			762	1,905	2,084,000	9,217	7,551,442	211,301
Nebraska							366,617	15,937
Ohio							272,843	18,937
South Dakota							135,893	6,941
Tennessee							2,774,560	87,537
West Virginia							161,287	12,112
Wisconsin					16,260,000	66,110	17,236,735	88,139
Total	4,950	1,238	1,620	4,050	47,648,000	216,404	96,797,437	1,781,029

Products by apparatus.—The most important forms of apparatus employed in the fisheries of the Mississippi River and tributaries, as determined by the quantity and value of the products secured, are seines, fyke nets, lines, and the various appliances used in the capture of mussels. The yield of seines, including all species, aggregated 19,593,614 pounds, $548,054; fyke nets, 17,030,138 pounds, $514,690; lines of all kinds, 6,736,087 pounds, $278,400; apparatus in the mussel fishery, 47,648,000 pounds, or 23,824 tons, $216,404. Trammel nets were also used extensively, their catch amounting to 3,029,903 pounds, valued at $82,698.

Table showing, by apparatus of capture, the yield of the fisheries of the Mississippi River and tributaries in 1899.

Species.	Seines.		Trammel nets.		Gill nets.		Fyke nets.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	215,153	$14,189	124,418	$6,960	9	$1	231,119	$14,725
Buffalo-fish	5,254,144	123,444	1,201,403	27,894	20,000	400	5,846,586	147,526
Carp, German	6,953,689	167,224	674,278	14,506	40,000	800	3,999,986	101,470
Cat-fish	1,102,660	49,812	235,299	9,064	.....	.....	2,281,883	107,742
Crappie	466,966	21,387	169,590	8,390	1,015	41	507,495	22,589
Drum, fresh-water	935,888	28,269	109,697	2,676	.....	.....	1,229,051	40,621
Eels	1,450	85	.....	.....	.....	.....	8,817	497
Mooneye	13,980	555	.....	.....	60	3	2,826	121
Paddle-fish	1,843,101	44,446	26,920	866	.....	.....	593,099	9,882
Pike and pickerel	64,104	2,897	31,985	1,325	500	25	20,123	936
Pike perch (wall-eyed)	39,495	2,538	8,899	499	50	6	51,200	3,408
Pike perch (sauger)	13,626	544	2,465	90	500	25	13,032	713
Shad	6,640	333	.....	.....	125	6	190	16
Sturgeon, lake	90,301	2,790	16,644	575	.....	.....	40,530	1,740
Sturgeon, shovel-nose	216,019	5,861	98,200	1,715	.....	.....	99,891	2,575
Suckers	882,191	28,792	220,773	5,419	175	13	948,910	34,714
Sun-fish	408,454	9,246	82,270	1,888	2,500	50	366,899	8,639
White bass and rock bass	138,991	5,231	13,702	610	.....	.....	102,222	4,425
Yellow perch	20,615	544	1,810	58	.....	.....	26,395	1,328
Other fish	485,390	5,817	10,650	145	.....	.....	352,202	3,859
Turtles and terrapin	370,457	7,311	900	18	.....	.....	307,282	7,024
Caviar	70,300	26,739	.....	.....	.....	.....	400	140
Total	19,593,614	548,054	3,029,903	82,698	64,934	1,370	17,030,138	514,690

Species.	Pound nets.		Set lines.		Hand and other lines.		Spears.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	29,750	$1,501	25,505	$1,820	320,950	$17,328	.....	.....
Buffalo-fish	470,185	7,832	1,126,817	35,365	8,200	346	201,900	$3,703
Carp, German	22,230	438	153,662	4,301	.....	.....	1,100	110
Cat-fish	48,786	2,259	3,388,506	147,849	224,205	7,434	200	20
Crappie	49,085	2,447	29,395	2,274	93,486	4,092	.....	.....
Drum, fresh-water	21,290	389	677,541	28,160	625	10	180	18
Eels	800	16	82,668	4,195	.....	.....	.....	.....
Mooneye	.....	.....	200	12	.....	.....	.....	.....
Paddle-fish	5,400	144	4,730	176	.....	.....	.....	.....
Pike and pickerel	6,700	238	3,920	261	67,935	1,948	21,500	410
Pike perch (wall-eyed)	1,245	71	30,687	2,057	78,446	3,567	60	6
Pike perch (sauger)	1,275	70	5,025	193	3,400	164	.....	.....
Sturgeon, lake	13,050	402	36,620	1,457	.....	.....	37,000	1,100
Sturgeon, shovel-nose	14,500	258	196,183	6,948	.....	.....	86,700	1,775
Suckers	47,395	883	81,215	4,166	.....	.....	1,000	100
Sun-fish	26,615	453	6,590	550	17,450	489	.....	.....
White bass and rock bass	1,610	77	9,555	772	12,377	379	.....	.....
Yellow perch	175	8	12,136	686	3,875	42	.....	.....
Other fish	1,250	34	16,603	858	100	4	.....	.....
Turtles and terrapin	.....	.....	17,480	497	.....	.....	.....	.....
Frogs	.....	.....	.....	.....	.....	.....	122,604	15,304
Total	761,341	17,520	5,905,038	242,597	831,049	35,803	472,244	22,546

Table showing, by apparatus of capture, the yield of the fisheries of the Mississippi River and tributaries in 1899—Continued.

Species.	Small traps.		Other apparatus.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	1,000	$100	280	$28	948,184	$56,652
Buffalo-fish	74,340	3,043	12,400	360	14,215,975	349,913
Carp, German	770	39	23,125	370	11,868,840	289,258
Cat-fish	244,415	11,577	122,225	4,043	7,648,179	339,800
Crappie	1,000	100	800	80	1,318,832	61,400
Drum, fresh-water	169,460	8,473	5,500	170	3,149,232	108,786
Eels	170	10	.....	.....	93,905	4,803
Mooneye	.....	.....	300	15	17,366	706
Paddle-fish	.....	.....	.....	.....	2,473,250	55,514
Pike and pickerel	.....	.....	185	5	216,952	8,045
Pike perch (wall-eyed)	.....	.....	30	4	210,112	12,156
Pike perch (sauger)	.....	.....	.....	.....	39,323	1,799
Shad	.....	.....	.....	.....	6,955	355
Sturgeon, lake	.....	.....	.....	.....	234,145	8,064
Sturgeon, shovel-nose	.....	.....	200	10	711,693	19,142
Suckers	56,400	2,820	5,875	86	2,243,934	76,993
Sun-fish	.....	.....	185	3	910,963	21,318
White bass and rock bass	.....	.....	.....	.....	278,457	11,494
Yellow perch	.....	.....	.....	.....	65,006	2,666
Other fish	131,600	6,580	.....	.....	997,795	17,297
Shrimp	200,058	16,095	.....	.....	200,058	16,095
Turtles and terrapin	.....	.....	85,896	2,298	782,015	17,148
Frogs	.....	.....	318,392	37,750	440,996	53,054
Caviar	.....	.....	.....	.....	70,700	26,879
Alligator hides	.....	.....	†4,950	1,238	4,950	1,238
Otter skins	*1,260	3,150	‡360	900	1,620	4,050
Mussel shells	.....	.....	47,648,000	216,404	47,648,000	216,404
Total	880,473	51,987	48,228,703	263,764	96,797,437	1,781,029

* 630 in number. † 990 in number. ‡ 180 in number.

THE PEARL-BUTTON INDUSTRY.

The manufacture of pearl buttons from the shells of mussels taken in the fisheries of the Mississippi River was begun at Muscatine, Iowa, in 1891, and has now become an important industry. In 1899 there were 41 button factories in Iowa, 11 in Illinois, 6 in Missouri, and 2 in Wisconsin; a total of 60, valued at $224,010. Of these 14 were complete plants where finished buttons are made, 12 of which were in Iowa, 1 in Illinois, and 1 in Missouri. The other factories were engaged in sawing button blanks, which are shipped to New York and other Eastern cities, where they are made into buttons. The persons employed in the factories numbered 1,917, and the cash capital utilized amounted to $150,450. The products consisted of 1,073,553 gross of buttons, valued at $336,504, and 3,146,413 gross of button blanks, valued at $479,931, the total value of the output being $816,435.

The following shows the extent of the pearl-button industry in 1899:

Items.	Illinois.		Missouri.		Iowa.		Wisconsin.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Val.	No.	Value.
Factories	11	$27,200	6	$14,800	41	$175,650	2	$6,360	60	$224,010
Cash capital	.....	21,050	.....	14,650	.....	102,250	.....	12,500	.....	150,450
Persons employed	293	.....	121	.....	1,445	.....	58	.....	1,917	.....
Mussel shells used, tons	2,226	27,782	620	5,930	8,434	101,219	520	4,224	11,800	139,155
Products prepared:										
Buttons, gross	96,820	29,850	50,000	12,500	926,733	294,154	.....	.....	1,073,553	336,504
Button blanks, do	760,998	120,714	164,400	20,070	2,147,972	330,252	73,043	8,895	3,146,413	479,931

WEST VIRGINIA.

The fisheries of West Virginia are prosecuted in the Ohio River. In 1899 the number of persons employed in them was 86, the investment was $3,591, and the products amounted to 161,287 pounds, valued at $12,112.

The apparatus of capture consisted principally of 138 fyke nets, valued at $1,382; 18 seines, valued at $680, and 157 set lines, valued at $201. The species of fish taken in greatest quantity were cat-fish, 58,600 pounds, $3,120; fresh-water drum, 28,148 pounds, $2,833, and suckers, 55,150 pounds, $4,227. Nearly half of the total yield was obtained with fyke nets.

Table showing the number of persons employed in the fisheries of West Virginia in 1899.

Fisheries in which employed.	No.
Seine	50
Gill net	1
Fyke net	43
Set line	61
Total (exclusive of duplication)	86

Table showing the boats, apparatus, and property employed in the fisheries of West Virginia in 1899.

Items.	No.	Value.
Fishing boats	58	$983
House boats	6	245
Set lines (15,725 yards)	157	201
Fyke nets	138	1,382
Seines (672 yards)	18	680
Gill nets (30 yards)	1	5
Shore and accessory property		95
Total investment		3,591

Table showing, by apparatus of capture, the yield of the fisheries of West Virginia in 1899.

Species.	Set lines.		Fyke nets.		Seines.		Gill nets.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	350	$51	150	$15	355	$46			855	$112
Buffalo-fish	500	50	1,060	94	600	52			2,160	196
Carp, German	1,000	80			5,410	410			6,410	490
Cat-fish	18,665	1,027	35,900	1,815	4,035	278			58,600	3,120
Crappie	100	12							100	12
Drum, fresh-water	7,040	764	8,072	803	13,036	1,266			28,148	2,833
Eels	495	57	260	26					755	83
Pike					30	5			30	5
Pike perch (sauger)	50	8	1,067	128	295	37			1,412	173
Pike perch (wall-eyed)	100	15	1,659	170	795	109			2,554	294
Rock bass	200	30			385	40			585	70
Shad							125	$6	125	6
Sturgeon, lake	1,670	177			400	40			2,070	217
Sturgeon, shovel-nose	1,968	201							1,968	201
Suckers	2,475	195	24,455	1,947	28,120	2,077	100	8	55,150	4,227
Sun-fish	140	50			25	4			165	54
Turtles			200	19					200	19
Total	34,753	2,717	72,823	5,017	53,486	4,364	225	14	161,287	12,112

OHIO.

The fisheries of Ohio conducted in the Ohio River, the only tributary of the Mississippi in which this State has fisheries, gave employment in 1899 to 182 persons. The amount of capital invested was $6,864, and the products aggregated 272,843 pounds, valued at $18,937. The principal species taken were cat-fish, 110,396 pounds, worth $5,547; fresh-water drum, 60,077 pounds, worth $5,334, and suckers, 74,416 pounds, worth $5,452. Fyke nets and seines were the most important forms of apparatus employed.

Table showing the number of persons employed in the fisheries of Ohio in 1899.

Fisheries in which employed.	No.
Seine	70
Fyke net	90
Gill net	2
Set line	143
Without apparatus	12
Total (exclusive of duplication)	182

Table showing the boats, apparatus of capture, and shore property employed in the fisheries of Ohio in 1899.

Items.	No.	Value.
Fishing boats	150	$2,050
House boats	10	705
Seines (1,255 yards)	30	1,200
Fyke nets	281	2,270
Gill nets (55 yards)	1	10
Set lines	346	439
Shore and accessory property	.....	190
Total investment	.....	6,864

Table showing, by apparatus of capture, the yield of the fisheries of Ohio in 1899.

Species.	Seines.		Fyke nets.		Gill nets.		Set lines.		Without apparatus.		Total.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Black bass	800	$96	357	$37	9	$1	300	$32	.....	.....	1,466	$166
Buffalo-fish	1,172	95	2,951	252	.....	.....	424	39	.....	.....	4,547	386
Carp, German	7,805	466	1,302	117	.....	.....	225	23	.....	.....	9,332	606
Cat-fish	7,864	406	62,780	3,108	.....	.....	39,752	2,033	.....	.....	110,396	5,547
Crappie	.....	.....	.....	.....	15	1	.....	.....	.....	.....	15	1
Drum, fresh-water	27,955	2,375	18,717	1,727	.....	.....	13,405	1,232	.....	.....	60,077	5,334
Eels	.....	.....	265	27	.....	.....	353	36	.....	.....	618	63
Mooneye or tooth herring	.....	.....	.....	.....	60	3	.....	.....	.....	.....	60	3
Pike perch (wall-eyed)	834	94	2,678	281	50	6	112	11	.....	.....	3,674	392
Pikeperch (sauger)	146	15	2,352	245	.....	.....	.....	.....	.....	.....	2,498	260
Rock bass	455	46	.....	.....	.....	.....	.....	.....	.....	.....	455	46
Sturgeon, lake	.....	.....	.....	.....	.....	.....	835	86	.....	.....	835	86
Sturgeon, shovel-nose	280	11	.....	.....	.....	.....	2,459	264	.....	.....	2,739	275
Suckers	39,478	2,518	29,793	2,420	75	5	5,070	509	.....	.....	74,416	5,452
Sun-fish	390	27	.....	.....	.....	.....	.....	.....	.....	.....	390	27
Turtles	.....	.....	975	83	.....	.....	.....	.....	.....	.....	975	83
Frogs	.....	.....	.....	.....	.....	.....	.....	.....	350	$210	350	210
Total	87,179	6,149	122,170	8,297	209	16	62,935	4,265	350	210	272,843	18,937

INDIANA.

The fisheries of Indiana, in waters tributary to the Mississippi River, are not extensive. The number of persons engaged in them in 1899 was 409; the investment was $19,731, and the products amounted to 950,784 pounds, valued at $55,011. The apparatus of capture consisted principally of seines, fyke nets, and set nets. The principal species of fish obtained were cat-fish, 287,817 pounds, worth $17,572; buffalo-fish, 141,515 pounds, worth $7,677; fresh-water drum, 192,743 pounds, worth $10,613; and suckers, 155,859 pounds, worth $8,768. The yield was mostly derived from the Ohio and Wabash rivers.

Table showing the number of persons employed in the fisheries of Indiana in 1899.

Waters.	Fisheries in which employed.				Total, exclusive of duplication.
	Seine.	Fyke net.	Set line.	Spears.	
Ohio River	111	128	185	.....	224
Wabash River	41	46	108	8	143
White River	.....	6	14	.....	14
West Fork of White River	.....	7	15	.....	18
Tippecanoe River	7	3	5	.....	10
Total	159	190	327	8	409

Table showing, by waters, the boats, apparatus, and property employed in the fisheries of Indiana in 1899.

Waters and apparatus.	No.	Length.	Value.
		Yards.	
Ohio River:			
Gasoline launch	1	.....	$700
Rowboats	190	.....	1,234
House boats	52	.....	2,740
Haul seines	53	5,765	2,450
Fyke nets	930	.....	5,247
Set lines	769	77,610	837
Shore and accessory property	.....	.....	477
Wabash River:			
Steamboat	1	.....	500
Rowboats	117	.....	596
House boats	19	.....	710
Haul seines	15	1,352	585
Fyke nets	434	.....	2,170
Set lines	414	20,340	214
Spears	8	.....	10
Shore and accessory property	.....	.....	245
White River:			
Rowboats	14	.....	70
House boats	2	.....	50
Fyke nets	32	.....	160
Set lines	56	2,600	26
Shore and accessory property	.....	.....	26
West Fork of White River:			
Rowboats	18	.....	89
House boat	1	.....	30
Fyke nets	27	.....	135
Set lines	62	1,550	16
Shore and accessory property	.....	.....	77
Tippecanoe River:			
Rowboats	7	.....	33
Haul seines	3	300	115
Fyke nets	35	.....	175
Set lines	23	1,100	11
Shore and accessory property	.....	.....	3
Total investment	.....	.....	19,731

Table showing, by waters and apparatus of capture, the yield of the fisheries of Indiana in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Cat-fish.		Crappie.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Ohio River	748	$51	30,090	$1,151	24,645	$1,065	352	$21
Wabash River	1,344	135	5,750	531	3,125	313	65	7
Tippecanoe River	662	66	200	20	508	51	.....	.....
Total	2,754	252	36,040	1,702	28,278	1,429	417	28
Fyke nets:								
Ohio River	704	57	51,611	2,569	99,176	4,862	2,815	166
Wabash River	1,822	179	6,913	572	34,866	3,074	389	35
White River	60	6	1,463	104	4,300	444	.....	.....
West Fork of White River	80	8	2,910	225	3,890	311	.....	.....
Tippecanoe River	143	14	.....	.....	562	56	.....	.....
Total	2,809	264	62,897	3,470	142,794	8,747	3,204	201
Lines:								
Ohio River	333	33	26,390	1,214	62,860	2,976	.....	.....
Wabash River	1,305	131	11,933	937	42,713	3,495	503	47
White River	.....	.....	1,210	87	5,200	416	.....	.....
West Fork of White River	250	25	2,220	184	4,972	409	.....	.....
Tippecanoe River	.....	.....	125	13	800	80	.....	.....
Total	1,888	189	41,878	2,435	116,545	7,376	503	47
Spears:								
Wabash River	.....	.....	700	70	200	20	.....	.....
Total by waters:								
Ohio River	1,785	141	108,091	4,934	186,681	8,903	3,167	187
Wabash River	4,471	445	25,296	2,110	80,904	6,902	957	89
White River	60	6	2,673	191	9,500	860	.....	.....
West Fork of White River	330	33	5,130	409	8,862	720	.....	.....
Tippecanoe River	805	80	325	33	1,870	187	.....	.....
Grand total	7,451	705	141,515	7,677	287,817	17,572	4,124	276

Apparatus and waters.	Drum, fresh-water.		Eels.		Carp, German.		Mooneye.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Ohio River	60,120	$2,833	.....	.....	11,213	$682	3,660	$137
Wabash River	4,539	426	.....	.....	6,850	649	.....	.....
Tippecanoe River	844	84	.....	.....	1,160	116	.....	.....
Total	65,503	3,343	.....	.....	19,223	1,447	3,660	137
Fyke nets:								
Ohio River	62,148	3,138	87	$7	3,883	154	355	23
Wabash River	7,291	593	.....	.....	1,535	120	.....	.....
White River	737	59	.....	.....	540	32	.....	.....
West Fork of White River	1,300	98	.....	.....	600	42	.....	.....
Tippecanoe River	400	40	.....	.....	105	11	.....	.....
Total	71,876	3,928	87	7	6,663	359	355	23
Lines:								
Ohio River	37,007	1,934	519	19	525	18	.....	.....
Wabash River	12,842	967	3,560	312	3,100	277	200	12
White River	2,340	187	350	28	420	25	.....	.....
West Fork of White River	2,605	215	430	45	250	20	.....	.....
Tippecanoe River	390	39	132	13	120	12	.....	.....
Total	55,184	3,342	4,991	417	4,415	352	200	12
Spears:								
Wabash River	180	18	.....	.....	1,100	110	.....	.....
Total by waters:								
Ohio River	159,275	7,905	606	26	15,621	854	4,015	160
Wabash River	24,852	2,004	3,560	312	12,585	1,156	200	12
White River	3,077	246	350	28	960	57	.....	.....
West Fork of White River	3,905	313	430	45	850	62	.....	.....
Tippecanoe River	1,634	163	132	13	1,385	139	.....	.....
Grand total	192,743	10,631	5,078	424	31,401	2,268	4,215	172

Table showing the yield of the fisheries of Indiana in 1899—Continued.

Apparatus and waters.	Paddle-fish.		Pike perch (wall-eyed).		Pike perch (sauger).		Rock bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Ohio River	30,455	$1,138	481	$25	.....	.....	88	$4
Wabash River	.....	.....	2,074	208	.....	.....	163	17
Tippecanoe River	.....	.....	519	52	.....	.....	310	31
Total	30,455	1,138	3,074	285	.....	.....	561	52
Fyke nets:								
Ohio River	1,330	59	1,441	124	200	$10	1,003	59
Wabash River	920	50	1,469	138	.....	.....	1,488	137
West Fork of White River	.....	.....	.....	.....	.....	.....	100	10
Tippecanoe River	.....	.....	148	15	.....	.....	82	8
Total	2,250	109	3,058	277	200	10	2,673	214
Lines:								
Ohio River	1,420	61	280	28	.....	.....	.....	.....
Wabash River	.....	.....	2,163	211	.....	.....	640	64
White River	.....	.....	20	2	.....	.....	.....	.....
West Fork of White River	.....	.....	50	5	.....	.....	.....	.....
Tippecanoe River	.....	.....	225	23	.....	.....	197	20
Total	1,420	61	2,738	269	.....	.....	837	84
Spears:								
Wabash River	.....	.....	60	6	.....	.....	.....	.....
Total by waters:								
Ohio River	33,205	1,258	2,202	177	200	10	1,091	63
Wabash River	920	50	5,766	563	.....	.....	2,291	218
White River	.....	.....	20	2	.....	.....	.....	.....
West Fork of White River	.....	.....	50	5	.....	.....	100	10
Tippecanoe River	.....	.....	892	90	.....	.....	589	59
Grand total	34,125	1,308	8,930	837	200	10	4,071	350

Apparatus and waters.	Shad.		Sturgeon, lake.		Sturgeon, shovel-nose.		Suckers.		Sun-fish.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Ohio River	140	$8	2,760	$98	15,823	$572	64,290	$2,576	900	$27
Wabash River	.....	.....	.....	.....	1,590	133	20,229	1,839	3,870	387
Tippecanoe River	.....	.....	.....	.....	.....	.....	2,140	214	775	78
Total	140	8	2,760	98	17,413	705	86,659	4,629	5,545	492
Fyke nets:										
Ohio River	140	11	195	8	3,570	210	37,347	1,712	400	20
Wabash River	.....	.....	.....	.....	1,386	91	18,858	1,469	2,348	205
White River	.....	.....	.....	.....	.....	.....	1,618	105	.....	.....
West Fork of White River	.....	.....	.....	.....	.....	.....	3,647	262	.....	.....
Tippecanoe River	.....	.....	.....	.....	.....	.....	300	30	.....	.....
Total	140	11	195	8	4,956	301	61,770	3,578	2,748	225
Lines:										
Ohio River	.....	.....	750	25	11,190	473	.....	.....	.....	.....
Wabash River	.....	.....	.....	.....	4,330	343	5,910	423	300	30
White River	.....	.....	.....	.....	1,600	116	340	20	.....	.....
West Fork of White River	.....	.....	.....	.....	.....	.....	180	18	.....	.....
Total	.....	.....	750	25	17,120	932	6,430	461	300	30
Spears:										
Wabash River	.....	.....	.....	.....	.....	.....	1,000	100	.....	.....
Total by waters:										
Ohio River	280	19	3,705	131	30,583	1,255	101,637	4,288	1,300	47
Wabash River	.....	.....	.....	.....	7,306	567	45,997	3,831	6,518	622
White River	.....	.....	.....	.....	1,600	116	1,958	125	.....	.....
West Fork of White River	.....	.....	.....	.....	.....	.....	3,827	280	.....	.....
Tippecanoe River	.....	.....	.....	.....	.....	.....	2,440	244	775	78
Grand total	280	19	3,705	131	39,489	1,938	155,859	8,768	8,593	747

Table showing the yield of the fisheries of Indiana in 1899—Continued.

Apparatus and waters.	White bass.		Yellow perch.		Other fish.		Turtles.		Total.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Ohio River			4,180	$186			1,560	$53	251,505	$10,627
Wabash River	545	$55					340	17	50,484	4,717
Tippecanoe River	222	23							7,340	735
Total	767	78	4,180	186			1,900	70	309,329	16,079
Fyke nets:										
Ohio River			5,706	308	250	$18	1,139	49	273,500	13,564
Wabash River	369	35					735	39	80,389	6,737
White River									8,718	750
West Fork of White River									12,527	956
Tippecanoe River	55	6							1,795	180
Total	424	41	5,706	308	250	18	1,874	88	376,929	22,187
Lines:										
Ohio River			4,316	286			800	32	146,390	7,099
Wabash River	191	19					780	52	90,470	7,320
White River									11,480	881
West Fork of White River									10,957	921
Tippecanoe River									1,989	200
Total	191	19	4,316	286			1,580	84	261,286	16,421
Spears:										
Wabash River									3,240	324
Total by waters:										
Ohio River			14,202	780	250	18	3,499	134	671,395	31,290
Wabash River	1,105	109					1,855	108	224,583	19,098
White River									20,198	1,631
West Fork of White River									23,484	1,877
Tippecanoe River	277	29							11,124	1,115
Total	1,382	138	14,202	780	250	18	5,354	242	950,784	55,011

ILLINOIS.

The fisheries of Illinois in 1889 were more extensive than those of any other State bordering the Mississippi River or any of its tributaries. The total number of persons engaged was 2,389, most of whom were employed on the Mississippi and Illinois rivers. The investment in the fisheries amounted to $225,324. The number of boats, including house boats, used in the fisheries was 1,717, valued at $54,808. The most productive forms of fishing apparatus were fyke nets and seines, of which 13,614 of the former, worth $65,164, and 303 of the latter, worth $27,780, were used. The catch secured with seines was 9,781,637 pounds, worth $251,562, and with fyke nets 7,608,123 pounds, worth $210,054.

The total yield of the fisheries of this State was 28,479,807 pounds, valued at $579,168. The most important species taken were German carp, 9,896,499 pounds, valued at $244,322; and buffalo-fish, 4,050,941 pounds, valued at $111,707. Other species were cat-fish, 1,569,615 pounds, $68,535; black bass, 126,180 pounds, $10,842; fresh-water drum, 610,205 pounds, $17,729; dog-fish, 802,750 pounds, $8,695; sunfish, 543,387 pounds, $12,067; and turtles and terrapin, 681,679 pounds, $14,520. The yield of mussel shells, utilized in the pearl-button industry, was 8,910,000 pounds, valued at $43,468.

A little more than half of the products of the fisheries of this State,

or 14,479,915 pounds, valued at $382,372, was derived from the Illinois River. Of the remainder, 13,371,923 pounds, worth $164,655, were from the Mississippi River, and 627,969 pounds, valued at $32,141, from various other waters.

The greater part of the carp taken from the Illinois River in 1899 was shipped to New York and other Eastern markets. The fish are packed alive, ice being put in the bottom and top of the box. When thus packed those in the top layer will live for two or three days in a torpid condition, those in the bottom dying sooner. Fifty-five carloads of carp (including about 5 per cent of buffalo), of 20,000 pounds each, were shipped from Havana, Ill., in 1899. Most of these fish went to New York, but Boston is also an important market for this species. The shipments were made by freight, and it took them about a week to reach their destination. The largest shipments are made in the winter. At Havana the boxes were made especially for the purpose, and contained 150 pounds of fish each. In 1894 the catch of carp for the whole Mississippi system was only 1,448,217 pounds. Since that time nearly all of the important commercial species of the Illinois River have been taken in increased quantities.

A considerable quantity of dog-fish or "grinnel cat" was utilized, all taken in this river; the total quantity was 802,750 pounds, valued at $8,695.

Among the principal fishing localities are Henry, Chillicothe, Peoria, Pekin, Havana, Browning, Beardstown, and Meredosia, but commercial fishing of more or less importance is carried on at points all along the river from Ottawa to Grafton.

The reptilian fisheries of the Illinois River are deserving of some notice, the catch of snapping turtle and terrapin in the year 1899 being 546,616 pounds, valued at $11,910, and of frogs 26,610 pounds, valued at $3,224. Philadelphia is one of the principal markets for the turtles and terrapin. In some cases the frogs are dressed by removing the head, skin, and viscera, the remainder being used for food.

The yield of turtles and terrapin might have been much larger had all of those taken been marketed. Many of the fishermen do not save their catch, the prices received for terrapin being small when only a few are caught in connection with other fishing. Snappers sometimes congregate in holes, and long iron rods terminating in hooks are used to pull them from these retreats; quite a number are picked up by hand in the spring. Snappers are usually sold by the pound and terrapin by the dozen. A shipper of Pekin keeps the animals in pounds until ready for shipment, feeding the snappers on live fish and the terrapin on watermelons, which they eat readily, including the rind.

The frog fishery is a rather irregular one. Rifles are used largely in taking frogs, but they are also caught with hooks suspended from poles, and with "spears," consisting of a rod or pole with a straightened fishhook attached to the end.

At some of the towns on the river fishing is the principal if not the sole industry. Grafton is situated at the confluence of the Mississippi and Illinois rivers, and fishing from this point is conducted about equally in both rivers. A large number of fyke nets are employed here and are usually called "bait nets," as it was formerly the custom of the fishermen to use bait in them. Each outfit, which, as a rule, is fished by two men and often consists of more than 100 nets, is provided with a vat for tarring the nets. Each net is provided with a line 60 to 75 feet long and a large stone for an anchor. The depth of these nets at the front or largest hoop is generally about 4 feet 8 inches. They are set with the mouth downstream, the stone anchor at the end of the line holding them securely, while the current keeps them in position. The total number of fyke nets credited to Grafton and fished in both rivers was 1,675, valued at $5,234.

Some of the fishermen operate in "lakes" that occur at intervals along the river's course, which, while connected with the river, are under private control. The exclusive right to fish in such lakes is sometimes quite valuable. In some cases payment is made in cash; in others a part of the catch is given for this privilege. A great many fish are also caught in sloughs. The catch from the lakes and sloughs is quite large.

Mussel shells.—The mussel-shell industry, which is of comparatively recent origin, has within the last year or two assumed considerable importance in this State. In addition to the fishermen engaged in gathering the mussels from the natural beds, the button-blank factories in 1899 gave employment to 293 persons.

The large increase in the quantity of products for the Mississippi River in this State, from 4,030,531 pounds in 1894 to 13,371,923 pounds in 1899, is due principally to the great advance in the mussel fishery, the yield of shells being 8,910,000 pounds, valued at $43,468, including $1,425 worth of pearls. The mussel-shell industry is rapidly extending, and in 1900 mussels were gathered as far down the Mississippi as Grafton and even below that point. Button-blank factories are increasing with the extension of the fishery.

Shells from northern waters turn out more blanks than those from lower down the river. In dressing, the niggerheads lose about 20 per cent and sand shells about 40 per cent. Some of the boats are provided with two drags or dredges, and others with four and even six. Each drag carries about 120 crowfoot hooks, or 30 lines with 4 hooks each. The crowfoot lines are attached to a hollow iron pipe, the dimensions of which are usually $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter and from 12 to 15 feet long. Mussels spawn early in the spring. A mussel shell 5 months old measures $\frac{3}{4}$ of an inch in diameter. A shell $2\frac{1}{2}$ to 3 years old will measure about $1\frac{3}{4}$ inches. The shells are soaked in water a week or ten days before they are cut, to soften the back of the shell and prevent brittleness in cutting.

Table showing, by waters, the number of persons employed in the fisheries of Illinois in 1899.

Waters.	Fisheries in which employed.												Total exclusive of duplication.
	Seine.	Trammel net.	Fyke net.	Gill net.	Pound net.	Set line.	Drift line.	Hand line.	Traps.	Crowfoot lines, etc.	Miscellaneous.	Shoresmen.	
Mississippi River	346	189	315	.....	8	256	16	.....	.....	322	18	298	1,149
Ohio River	23	.....	64	.....	.....	119	9	.....	.....	.....	.....	.....	132
Illinois River	522	57	510	24	.....	179	.....	7	40	.....	163	56	995
Kankakee River	.....	.....	.....	.....	.....	7	.....	6	.....	.....	.....	.....	7
Sangamon River	8	2	15	.....	.....	18	.....	.....	5	.....	.....	.....	15
Wabash River	.....	2	15	.....	.....	41	.....	8	.....	.....	.....	.....	47
Kaskaskia River	23	.....	13	.....	.....	10	.....	.....	11	.....	.....	.....	31
Big Muddy River	.....	.....	7	.....	.....	8	.....	.....	6	.....	.....	.....	13
Total	922	250	939	24	8	638	25	21	62	322	181	354	2,389

Table showing, by waters, the boats, apparatus, and capital employed in the fisheries of Illinois in 1899.

Waters.	Rowboats.		Steamboats.		House boats.		Seines.		
	No.	Value.	No.	Value.	No.	Value.	No.	Length (yards).	Value.
Mississippi River	731	$11,016	1	$600	46	$2,771	141	23,902	$6,771
Ohio River	125	625	.....	.....	33	1,530	12	1,222	515
Illinois River	546	9,746	15	10,035	115	17,712	135	52,162	19,926
Kankakee River	7	70	.....	.....	.....	.....	.....	.....	.....
Sangamon River	14	70	.....	.....	1	25	5	520	143
Wabash River	46	279	.....	.....	6	143	.....	.....	.....
Kaskaskia River	20	133	.....	.....	.....	.....	10	1,020	425
Big Muddy River	11	53	.....	.....	.....	.....	.....	.....	.....
Total	1,500	21,992	16	10,635	201	22,181	303	78,826	27,780

Waters.	Trammel nets.			Gill nets.			Fyke nets.		Pound nets.	
	No.	Length (yards).	Value.	No.	Length (yards).	Value.	No.	Value.	No.	Value.
Mississippi River	108	11,460	$2,708	.....	.....	.....	5,195	$18,146	6	$290
Ohio River	.....	.....	.....	.....	.....	.....	731	4,292	.....	.....
Illinois River	43	5,915	1,033	12	2,400	$240	7,310	41,152	.....	.....
Sangamon River	1	60	14	.....	.....	.....	111	313	.....	.....
Wabash River	1	85	40	.....	.....	.....	117	585	.....	.....
Kaskaskia River	.....	.....	.....	.....	.....	.....	118	528	.....	.....
Big Muddy River	.....	.....	.....	.....	.....	.....	32	148	.....	.....
Total	153	17,520	3,795	12	2,400	240	13,614	65,164	6	290

Waters.	Set lines.		Drift lines.		Hand lines.		Traps.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Mississippi River	1,017	$993	408	$41	.....	.....	.....	.....
Ohio River	539	532	310	31	.....	.....	.....	.....
Illinois River	680	759	.....	.....	10	$8	713	$709
Kankakee River	50	50	.....	.....	6	10	.....	.....
Sangamon River	312	17	.....	.....	.....	.....	94	94
Wabash River	166	83	.....	.....	8	5	.....	.....
Kaskaskia River	37	19	.....	.....	.....	.....	14	42
Big Muddy River	36	18	.....	.....	.....	.....	8	24
Total	2,837	2,471	718	72	24	23	829	869

Table showing, by waters, the boats, apparatus, and capital employed in the fisheries of Illinois in 1899—Continued.

Waters.	Value of crowfoot lines, rakes, etc.	Value of miscellaneous apparatus.	Shore and accessory property.	Cash capital.	Total investment.
Mississippi River	$2,144	$55	$34,085	$21,050	$100,670
Ohio River			157		7,682
Illinois River		133	11,491		112,944
Kankakee River			20		150
Sangamon River			103		779
Wabash River			14		1,149
Kaskaskia River			350		1,497
Big Muddy River			210		453
Total	2,144	188	46,430	21,050	225,324

Table showing, by waters and apparatus of capture, the yield of the fisheries of Illinois in 1899.

Apparatus and waters.	Crappie.		Dog-fish.		Drum, fresh-water.		Eels.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	35,556	$1,434			108,234	$2,855		
Ohio River	20	2			8,090	554		
Illinois River	166,388	6,432	458,950	$5,597	100,889	2,162	900	$52
Kaskaskia River	825	83			1,470	66		
Total	202,789	7,951	458,950	5,597	218,683	5,637	900	52
Trammel nets:								
Mississippi River	450	18			18,762	477		
Illinois River	7,700	361	10,000	140	120	5		
Wabash River					323	19		
Total	8,150	379	10,000	140	19,205	501		
Fyke nets:								
Mississippi River	20,278	860			75,718	1,790	240	14
Ohio River	1,108	115			61,600	3,196		
Illinois River	118,265	4,726	333,800	2,958	126,231	2,565		
Wabash River	385	32			1,628	79		
Kaskaskia River	772	77			1,976	87		
Big Muddy River	402	41			910	46		
Total	141,210	5,851	333,800	2,958	268,063	7,763	240	14
Gill nets:								
Illinois River	1,000	40						
Pound nets:								
Mississippi River	760	31			1,680	47		
Set lines:								
Mississippi River					49,302	1,363	15,810	923
Ohio River					33,804	1,973	2,285	119
Illinois River					17,828	343	9,133	436
Kankakee River	600	48						
Wabash River	205	17			1,380	89	655	46
Kaskaskia River							70	4
Total	805	65			102,314	3,768	27,953	1,528
Hand lines:								
Illinois River	1,181	63						
Wabash River	425	39						
Total	1,606	102						
Traps:								
Illinois River							170	10
Big Muddy River					260	13		
Total by waters:								
Mississippi River	57,044	2,343			253,696	6,532	16,050	937
Ohio River	1,128	117			103,494	5,723	2,285	119
Illinois River	294,534	11,622	802,750	8,695	245,068	5,075	10,203	498
Kankakee River	600	48						
Wabash River	1,015	88			3,331	187	655	46
Kaskaskia River	1,597	160			3,446	153	70	4
Big Muddy River	402	41			1,170	59		
Grand total	356,320	14,419	802,750	8,695	610,205	17,729	29,263	1,604

Table showing the yield of the fisheries of Illinois in 1899—Continued.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	9,895	$712	491,734	$13,027	920,066	$18,115	83,326	$4,257
Ohio River			2,725	160	1,795	73	1,201	88
Illinois River	52,570	4,722	1,061,326	29,006	4,787,630	120,074	394,533	14,253
Sangamon River			5,000	150	20,000	600		
Kaskaskia River			15,400	688	2,700	119	5,500	310
Total	62,465	5,434	1,576,185	43,031	5,732,191	138,981	484,560	18,908
Trammel nets:								
Mississippi River	2,345	184	318,713	7,410	191,430	3,455	32,745	1,676
Illinois River	1,000	100	61,300	1,737	197,238	5,305	8,414	350
Sangamon River			1,000	30	3,000	90		
Wabash River			575	35				
Total	3,345	284	381,588	9,212	391,668	8,850	41,159	2,026
Fyke nets:								
Mississippi River	6,254	334	682,503	17,595	300,287	5,629	147,467	7,715
Ohio River	660	71	65,265	3,106	11,651	529	27,682	1,492
Illinois River	46,459	4,091	1,160,626	32,156	3,282,054	85,961	274,950	10,472
Sangamon River			14,200	526	18,000	600		
Wabash River	747	67	2,800	134	1,396	58	10,341	502
Kaskaskia River			13,916	558	1,550	66	4,383	246
Big Muddy River	440	45	5,200	260	1,555	78	2,500	200
Total	54,560	4,608	1,944,510	54,335	3,616,493	92,921	467,323	20,627
Gill nets:								
Illinois River			20,000	400	40,000	800		
Pound nets:								
Mississippi River	250	20	10,545	300	7,665	219	2,300	149
Set lines:								
Mississippi River			71,603	2,098	27,250	565	189,565	10,363
Ohio River			34,510	1,741	1,032	46	46,060	3,148
Illinois River	500	40	1,100	27	77,065	1,818	222,428	7,632
Kankakee River	1,410	141			1,900	57	4,925	242
Sangamon River							8,200	368
Wabash River			2,360	181	315	18	14,940	1,150
Kaskaskia River							4,100	225
Big Muddy River			1,000	50	150	8	2,600	208
Total	1,910	181	110,573	4,097	107,712	2,512	492,818	23,336
Drift lines:								
Mississippi River			1,900	114			13,000	759
Ohio River			4,500	160			3,020	108
Total			6,400	274			16,020	867
Hand lines:								
Illinois River	2,050	155					620	35
Kankakee River	600	60						
Wabash River	1,000	100						
Total	3,650	315					620	35
Traps:								
Illinois River							43,975	1,698
Sangamon River							18,800	752
Kaskaskia River			625	32	470	24	1,300	78
Big Muddy River			515	26	300	15	740	59
Total			1,140	58	770	39	64,815	2,587
Total by waters:								
Mississippi River	18,744	1,250	1,576,998	40,544	1,446,698	27,983	468,403	24,919
Ohio River	660	71	107,000	5,167	14,478	648	77,963	4,836
Illinois River	102,579	9,108	2,304,352	63,326	8,383,987	213,958	944,920	34,440
Kankakee River	2,010	201			1,900	57	4,925	242
Sangamon River			20,200	706	41,000	1,290	27,000	1,120
Wabash River	1,747	167	5,735	350	1,711	76	25,281	1,652
Kaskaskia River			29,941	1,278	4,720	209	15,283	859
Big Muddy River	440	45	6,715	336	2,005	101	5,840	467
Grand total	126,180	10,842	4,050,941	111,707	9,896,499	244,322	1,569,615	68,535

Table showing the yield of the fisheries of Illinois in 1899—Continued.

Apparatus and waters.	Hickory shad.		Lawyer.		Mooneye or tooth herring.		Paddle-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	11,200	$7	1,210	$52	1,400	$43	137,676	$3,801
Ohio River					45	3	3,714	183
Illinois River	5,000	75					23,225	999
Kaskaskia River							5,200	234
Total	16,200	82	1,210	52	1,445	46	169,815	5,217
Fyke nets:								
Mississippi River					405	16	10,190	354
Ohio River					510	19	4,945	234
Illinois River							3,290	83
Wabash River					140	8	2,375	101
Kaskaskia River							2,266	105
Big Muddy River							1,648	82
Total					1,055	43	24,714	959
Trammel nets:								
Wabash River							295	18
Set lines:								
Mississippi River							350	16
Total by waters:								
Mississippi River	11,200	7	1,210	52	1,805	59	148,216	4,171
Ohio River					555	22	8,659	417
Illinois River	5,000	75					26,515	1,082
Wabash River					140	8	2,670	119
Kaskaskia River							7,466	339
Big Muddy River							1,648	82
Grand total	16,200	82	1,210	52	2,500	89	195,174	6,210

Apparatus and waters.	Pike and pickerel.		Pike perch (wall-eyed).		Sturgeon, lake.		Sturgeon, shovel-nose.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	2,855	$161	5,188	$345	12,885	$473	16,806	$641
Ohio River			125	12	200	8	400	21
Illinois River	9,739	622	3,753	233				
Total	12,594	783	9,066	590	13,085	481	17,206	662
Trammel nets:								
Mississippi River	1,070	61	1,265	80	9,724	296	50,500	810
Illinois River	520	31	64	6			8,000	160
Total	1,590	92	1,329	86	9,724	296	58,500	970
Fyke nets:								
Mississippi River	785	47	3,242	179	2,125	91	12,438	284
Ohio River			722	71	1,150	68		
Illinois River	5,922	347	7,259	390	635	23	10,374	218
Wabash River			261	21			825	37
Total	6,707	394	11,484	661	3,910	182	23,637	539
Set lines:								
Mississippi River	765	40	5,345	286	6,240	234	24,900	420
Ohio River			76	8	1,850	86	200	10
Kankakee River	630	54	300	30				
Wabash River			584	51			400	24
Total	1,395	94	6,305	375	8,090	320	25,500	454
Hand lines:								
Kankakee River	300	24	150	15				
Wabash River			546	47				
Total	300	24	696	62				
Total by waters:								
Mississippi River	5,475	309	15,040	890	30,974	1,094	104,644	2,155
Ohio River			923	91	3,200	162	600	31
Illinois River	16,181	1,000	11,076	629	635	23	18,374	378
Kankakee River	930	78	450	45				
Wabash River			1,391	119			1,225	61
Total	22,586	1,387	28,880	1,774	34,809	1,279	124,843	2,625

Table showing the yield of the fisheries of Illinois in 1899—Continued.

Apparatus and waters.	Rock bass.		Suckers.		Sun-fish.		White bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	2,494	$136	53,632	$1,526	21,966	$667	4,355	$184
Ohio River	60	6	3,599	179	450	20	.....	.....
Illinois River	25,060	499	26,940	523	275,175	5,752	68,980	2,369
Total	27,614	641	84,171	2,228	297,591	6,439	73,335	2,553
Trammel nets:								
Mississippi River	.....	.....	32,745	762	5,875	162	1,020	48
Illinois River	.....	.....	200	8	14,000	338	132	5
Total	.....	.....	32,945	770	19,875	500	1,152	53
Fyke nets:								
Mississippi River	1,113	70	37,633	1,083	5,800	200	1,475	69
Ohio River	887	86	45,960	2,080	300	13	.....	.....
Illinois River	17,702	438	40,650	869	214,901	4,715	40,421	1,450
Wabash River	630	50	14,255	644	200	16	360	29
Big Muddy River	.....	.....	150	5	.....	.....	.....	.....
Total	20,332	644	138,648	4,681	221,201	4,944	42,256	1,548
Gill nets:								
Illinois River	.....	.....	.....	.....	2,500	50	.....	.....
Pound nets:								
Mississippi River	.....	.....	1,600	45	.....	.....	.....	.....
Set lines:								
Mississippi River	100	10	.....	.....	.....	.....	240	16
Illinois River	.....	.....	.....	.....	.....	.....	50	2
Kankakee River	312	25	.....	.....	500	25	350	35
Wabash River	250	20	1,840	121	.....	.....	.....	.....
Total	662	55	1,840	121	500	25	640	53
Hand lines:								
Illinois River	.....	.....	.....	.....	1,104	51	.....	.....
Wabash River	600	54	.....	.....	616	58	.....	.....
Total	600	54	.....	.....	1,720	109	.....	.....
Total by waters:								
Mississippi River	3,707	216	125,610	3,416	33,641	1,029	7,090	317
Ohio River	947	92	49,559	2,259	750	33	.....	.....
Illinois River	42,762	937	67,790	1,400	507,690	10,906	109,583	3,826
Kankakee River	312	25	.....	.....	500	25	350	35
Wabash River	1,480	124	16,095	765	816	74	360	29
Big Muddy River	.....	.....	150	5	.....	.....	.....	.....
Grand total	49.208	1,394	259,204	7,845	543,397	12,067	117,383	4,207

Apparatus and waters.	Yellow perch.		Frogs.		Turtles and terrapin.		Mussel shells.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	.....	.....	.....	.....	102,810	$1,785	.....	.....
Ohio River	265	$11	.....	.....	520	23	.....	.....
Illinois River	9,850	197	.....	.....	208,137	4,181	.....	.....
Total	10,115	208	.....	.....	311,467	5,989	.....	.....
Trammel nets:								
Mississippi River	.....	.....	.....	.....	400	8	.....	.....
Fyke nets:								
Mississippi River	1,521	55	.....	.....	18,525	420	.....	.....
Ohio River	4,633	192	.....	.....	1,013	49	.....	.....
Illinois River	2,850	63	.....	.....	258,703	5,573	.....	.....
Wabash River	.....	.....	.....	.....	735	30	.....	.....
Total	9,004	310	.....	.....	278,976	6,072	.....	.....
Crowfoot lines, etc.:								
Mississippi River	.....	.....	.....	.....	.....	.....	8,910,000	*$43,468

*Including $1,425 worth of pearls.

Table showing the yield of the fisheries of Illinois in 1899—Continued.

Apparatus and waters.	Yellow perch.		Frogs.		Turtles and terrapin.		Mussel shells.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Set lines:								
Ohio River	820	$38			1,030	$47		
Illinois River					3,180	58		
Wabash River					730	48		
Total	820	38			4,940	153		
Miscellaneous:								
Mississippi River			4,422	$536	8,000	160		
Illinois River			26,610	3,224	76,596	2,098		
Sangamon River					*1,300	40		
Total			31,032	3,760	85,896	2,298		
Total by waters:								
Mississippi River	1,521	55	4,422	536	129,735	2,373	8,910,000	$43,468
Ohio River	5,718	241			2,563	119		
Illinois River	12,700	260	26,610	3,224	546,616	11,910		
Sangamon River					1,300	40		
Wabash River					1,465	78		
Grand total	19,939	556	31,032	3,760	681,679	14,520	8,910,000	43,468

*Taken by hand.

Summary, by apparatus and waters, of the fisheries of Illinois in 1899.

Apparatus and waters.	Lbs.	Value.
Seines:		
Mississippi River	2,023,288	$50,221
Ohio River	23,209	1,343
Illinois River	7,679,045	197,748
Sangamon River	25,000	750
Kaskaskia River	31,095	1,500
Total	9,781,637	251,562
Trammel nets:		
Mississippi River	667,044	15,447
Illinois River	308,688	8,546
Sangamon River	4,000	120
Wabash River	1,193	72
Total	980,925	24,185
Fyke nets:		
Mississippi River	1,327,999	36,805
Ohio River	228,086	11,321
Illinois River	5,945,092	157,098
Sangamon River	32,200	1,126
Wabash River	37,078	1,808
Kaskaskia River	24,863	1,139
Big Muddy River	12,805	757
Total	7,608,123	210,054
Gill nets:		
Illinois River	63,500	1,290
Pound nets:		
Mississippi River	24,800	811
Set lines:		
Mississippi River	391,470	16,334
Ohio River	121,667	7,216
Illinois River	331,284	10,356
Kankakee River	10,927	657
Sangamon River	8,200	368
Wabash River	23,659	1,765
Kaskaskia River	4,170	229
Big Muddy River	3,750	266
Total	895,127	37,191

Apparatus and waters.	Lbs.	Value.
Drift lines:		
Mississippi River	14,900	$873
Ohio River	7,520	268
Total	22,420	1,141
Hand lines:		
Illinois River	4,955	304
Kankakee River	1,050	99
Wabash River	3,187	298
Total	9,192	701
Traps:		
Illinois River	44,145	1,708
Sangamon River	18,800	752
Kaskaskia River	2,395	134
Big Muddy River	1,815	113
Total	67,155	2,707
Crowfoot lines, etc:		
Mississippi River	8,910,000	43,468
Miscellaneous:		
Mississippi River	12,422	696
Illinois River	103,206	5,322
Sangamon River	1,300	40
Total	116,928	6,058
Total by waters:		
Mississippi River	13,371,923	164,655
Ohio River	380,482	20,148
Illinois River	14,479,915	382,372
Kankakee River	11,977	756
Sangamon River	89,500	3,156
Wabash River	65,117	3,943
Kaskaskia River	62,523	3,002
Big Muddy River	18,370	1,136
Grand total	28,479,807	579,168

KENTUCKY.

The fisheries in Kentucky in 1899 gave employment to 589 persons, most of whom are credited to the Ohio and Mississippi rivers. The amount of capital invested in the industry was $87,286. Fyke nets were employed more extensively than any other form of apparatus.

The products amounted to 1,753,278 pounds, valued at $78,899, the greater part of which was derived from the Ohio River. The leading species taken were buffalo-fish, 471,643 pounds, worth $17,900; cat-fish, 415,934 pounds, worth $20,806, and fresh-water drum, 390,909 pounds, worth $18,715. Other important species were paddle-fish, suckers, and German carp. Shad (*Alosa ohiensis*) were taken in the Ohio River near Louisville, Ky., the catch being 6,550 pounds, valued at $330.

Statement, by waters, of the number of persons employed in the fisheries of Kentucky in 1899.

Waters.	Fisheries in which employed.							Shoresmen.	Total, exclusive of duplication.
	Seine.	Trammel net.	Fyke net.	Cast net.	Dip net.	Set line.	Hand and drift line.		
Ohio River	137	.....	204	4	8	237	24	30	432
Kentucky River	2	.....	10	.....	.....	30	1	.....	32
Green River	.....	.....	14	.....	.....	14	.....	.....	14
Cumberland River	.....	.....	19	.....	.....	19	.....	.....	19
Tennessee River	.....	.....	14	.....	.....	15	.....	.....	15
Mississippi River	12	14	40	.....	.....	48	6	8	77
Total	151	14	301	4	8	363	31	38	589

Table showing, by waters, the boats, apparatus, and capital employed in the fisheries of Kentucky in 1899.

Waters.	Fishing boats.		House boats.		Fyke nets.		Seines.		
	No.	Value.	No.	Value.	No.	Value.	No.	Length (yards).	Value.
Ohio River	311	$2,187	108	$5,732	1,390	$8,334	66	6,360	$2,635
Kentucky River	32	166	2	100	43	249	1	40	20
Green River	14	106	3	190	190	1,310	.....	.....	.....
Cumberland River	19	104	10	425	166	817	.....	.....	.....
Tennessee River	15	80	2	120	325	1,785	.....	.....	.....
Mississippi River	48	850	8	400	348	1,839	5	650	310
Total	439	3,493	133	6,967	2,462	14,334	72	7,050	2,965

Waters.	Trammel nets.			Cast nets.		Dip nets.	
	No.	Length (yards).	Value.	No.	Value.	No.	Value.
Ohio River	.....	.....	.....	4	$20	5	$7
Mississippi River	7	700	$160	.....	.....	.....	.....

Waters.	Set lines.		Hand and other lines.		Shore and accessory property.	Cash capital.	Total investment.
	No.	Value.	No.	Value.			
Ohio River	.....	.....	1,329	$1,142	$20,520	$30,000	$70,577
Kentucky River	.....	.....	113	61	15	.....	611
Green River	.....	.....	58	42	12	.....	1,660
Cumberland River	93	$93	.....	.....	35	.....	1,474
Tennessee River	112	78	.....	.....	21	.....	2,084
Mississippi River	248	210	120	12	1,599	5,500	10,880
Total	453	381	1,620	1,257	22,202	35,500	87,286

Table showing, by waters and apparatus of capture, the yield of the fisheries of Kentucky in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Ohio River	442	$42	44,326	$2,087	36,325	$1,788	27,495	$1,350
Kentucky River	112	11	300	15			370	19
Mississippi River	870	62	30,600	764	21,100	524	5,500	223
Total	1,424	115	75,226	2,866	57,425	2,312	33,365	1,592
Fyke nets:								
Ohio River	1,080	105	76,988	4,095	7,701	402	137,282	7,141
Kentucky River	1,220	122	677	34	245	12	1,690	84
Green River	885	71	14,300	870	180	10	8,100	648
Cumberland River	326	27	13,630	478			6,280	278
Tennessee River	552	55	15,141	667			12,319	590
Mississippi River	1,150	63	113,300	2,994	5,330	121	8,455	370
Total	5,213	443	234,036	9,138	13,456	545	174,126	9,111
Trammel nets:								
Mississippi River	170	14	18,900	560	6,400	208	6,800	256
Cast nets:								
Ohio River			700	35			800	40
Dip nets:								
Ohio River			650	33			700	35
Set lines:								
Ohio River	637	64	42,346	2,171	570	26	88,802	4,773
Kentucky River	1,327	133	2,335	117			11,800	592
Green River	550	44	800	48			6,700	536
Cumberland River	5,443	205	11,200	449	180	5		
Tennessee River			7,500	337			8,596	410
Mississippi River			76,150	2,074			78,175	3,191
Total	7,957	446	140,331	5,196	750	31	194,073	9,502
Hand and drift lines:								
Ohio River			1,800	72			5,590	246
Kentucky River	100	8					480	24
Total	100	8	1,800	72			6,070	270
Total by waters:								
Ohio River	2,159	211	166,810	8,493	44,596	2,216	260,669	13,585
Kentucky River	2,759	274	3,312	166	245	12	14,340	719
Green River	1,435	115	15,100	918	180	10	14,800	1,184
Cumberland River	5,769	232	24,830	927	180	5	6,280	278
Tennessee River	552	55	22,641	1,004			20,915	1,000
Mississippi River	2,190	139	238,950	6,392	32,830	853	98,930	4,040
Grand total	14,864	1,026	471,643	17,900	78,031	3,096	415,934	20,806

Apparatus and waters.	Shad.		Hickory shad.		Pike perch (wall-eyed).		Pike perch (sauger).	
	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Ohio River	6,500	$325			1,009	$90	2,000	$100
Mississippi River					470	32		
Total	6,500	325			1,479	122	2,000	100
Fyke nets:								
Ohio River	50	5	250	$20	3,136	307	130	13
Cumberland River					151	16		
Tennessee River					105	11		
Mississippi River					782	42		
Total	50	5	250	20	4,174	376	130	13
Set lines:								
Ohio River					280	28		
Cumberland River					55	6		
Total					335	34		
Total by waters:								
Ohio River	6,550	330	250	20	4,425	425	2,130	113
Cumberland River					206	22		
Tennessee River					105	11		
Mississippi River					1,252	74		
Grand total	6,550	330	250	20	5,988	532	2,130	113

Table showing the yield of the fisheries of Kentucky in 1899—Continued.

Apparatus and waters.	Crappie.		Drum, fresh-water.		Eels.		Rock bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Ohio River	106	$8	86,949	$4,844			239	$24
Kentucky River	120	12	400	20				
Mississippi River	900	64	8,300	198			700	44
Total	1,126	84	95,649	5,062			939	68
Fyke nets:								
Ohio River	2,581	199	93,119	5,631	125	$10	1,104	97
Kentucky River			1,240	63				
Green River	500	34	12,600	788			360	29
Cumberland River	210	21	8,200	306			200	20
Tennessee River	80	8	16,852	754			82	8
Mississippi River	1,080	46	58,500	946	930	33	1,225	73
Total	4,451	308	190,511	8,488	1,055	43	2,971	227
Trammel nets:								
Mississippi River	1,100	88	3,900	104				
Cast nets:								
Ohio River			1,200	60				
Dip nets:								
Ohio River			800	40				
Set lines:								
Ohio River			52,669	3,243	1,572	81		
Kentucky River			5,180	259				
Green River			5,300	332	100	6		
Cumberland River			7,000	266	43	1		
Tennessee River			10,500	469				
Mississippi River			18,200	392	1,130	39		
Total			98,849	4,961	2,845	127		
Hand and drift lines:								
Kentucky River	190	15					50	4
Total by waters:								
Ohio River	2,687	207	234,737	13,818	1,697	91	1,343	121
Kentucky River	310	27	6,820	342			50	4
Green River	500	34	17,900	1,120	100	6	360	29
Cumberland River	210	21	15,200	572	43	1	200	20
Tennessee River	80	8	27,352	1,223			82	8
Mississippi River	3,080	198	88,900	1,640	2,060	72	1,925	117
Grand total	6,867	495	390,909	18,715	3,900	170	3,960	299

Apparatus and waters.	Mooneye or tooth herring.		Paddle-fish.		Sturgeon, lake.		Sturgeon, shovel-nose.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Ohio River	5,280	$252	60,181	$2,942	1,406	$63	14,555	$668
Mississippi River			16,200	426				
Total	5,280	252	76,381	3,368	1,406	63	14,555	668
Fyke nets:								
Ohio River	516	37	16,024	818	65	4	8,795	356
Green River			700	42			300	18
Cumberland River					168	5	345	10
Tennessee River			145	4				
Mississippi River	300	3	53,300	661			3,500	37
Total	816	40	70,169	1,525	233	9	12,940	421
Trammel nets:								
Mississippi River			300	8				
Cast nets:								
Ohio River	300	15					200	10
Set lines:								
Ohio River			410	18	2,880	172	4,921	262
Mississippi River							3,000	30
Total			410	18	2,880	172	7,921	292
Total by waters:								
Ohio River	6,096	304	76,615	3,778	4,351	239	28,471	1,296
Green River			700	42			300	18
Cumberland River					168	5	345	10
Tennessee River			145	4				
Mississippi River	300	3	69,800	1,095			6,500	67
Grand total	6,396	307	147,260	4,919	4,519	244	35,616	1,391

Table showing the yield of the fisheries of Kentucky in 1899—Continued.

Apparatus and waters.	Suckers.		Sun-fish.		Yellow perch.		Turtles.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Ohio River	52,573	$2,545	1,320	$72	1,000	$40	1,271	$58
Kentucky River	200	10						
Mississippi River	1,900	35	600	30			800	16
Total	54,673	2,590	1,920	102	1,000	40	2,071	74
Fyke nets:								
Ohio River	59,915	3,718	815	40	7,675	555	3,715	169
Kentucky River	1,048	52						
Green River	7,395	473					190	8
Cumberland River	1,514	62						
Tennessee River	1,315	60						
Mississippi River	4,833	106					1,545	31
Total	76,020	4,471	815	40	7,675	555	5,450	208
Cast nets:								
Ohio River	400	20						
Set lines:								
Ohio River					5,125	330	1,412	68
Mississippi River							1,900	38
Total					5,125	330	3,312	106
Total by waters:								
Ohio River	112,888	6,283	2,135	112	13,800	925	6,398	295
Kentucky River	1,248	62						
Green River	7,395	473					190	8
Cumberland River	1,514	62						
Tennessee River	1,315	60						
Mississippi River	6,733	141	600	30			4,245	85
Grand total	131,093	7,081	2,735	142	13,800	925	10,833	388

Summary, by apparatus and waters, of the fisheries of Kentucky in 1899.

Apparatus and waters.	Lbs.	Value.	Apparatus and waters.	Lbs.	Value.
Seines:			Set lines:		
Ohio River	342,977	$17,298	Ohio River	201,624	$11,236
Kentucky River	1,502	87	Kentucky River	20,642	1,101
Mississippi River	87,940	2,418	Green River	13,450	966
Total	432,419	19,803	Cumberland River	23,921	932
Fyke nets:			Tennessee River	26,596	1,216
Ohio River	421,066	23,722	Mississippi River	178,555	5,764
Kentucky River	6,120	367	Total	464,788	21,215
Green River	45,510	2,991	Hand and drift lines:		
Cumberland River	31,024	1,223	Ohio River	7,390	318
Tennessee River	46,591	2,157	Kentucky River	820	51
Mississippi River	254,230	5,526	Total	8,210	369
Total	804,541	35,986	Total by waters:		
Cast nets:			Ohio River	978,807	52,862
Ohio River	3,600	180	Kentucky River	29,084	1,606
Dip nets:			Green River	58,960	3,957
Ohio River	2,150	108	Cumberland River	54,945	2,155
Trammel nets:			Tennessee River	73,187	3,373
Mississippi River	37,570	1,238	Mississippi River	558,295	14,946
			Grand total	1,753,278	78,899

Extent of the wholesale fishery trade in Kentucky in 1899.

Items.	No.	Value.
Establishments (one at Louisville and two at Hickman)	3	$21,350
Cash capital		35,500
Wages paid		21,712
Persons engaged	38	
Products sold:		
Fresh fish ..... pounds..	4,000,000	220,000
Oysters ..... gallons..	60,000	75,000

TENNESSEE.

The fisheries of Tennessee conducted in the Mississippi and waters tributary thereto employed 476 persons and required an investment of $92,883 in 1899. The yield was 2,774,560 pounds of products, valued at $87,537. More than half the catch was obtained in Reelfoot Lake, the Mississippi River being second with respect to the yield. Buffalo-fish, cat-fish, drum, suckers, and black bass are among the species taken in largest quantity. The catch of buffalo-fish amounted to 862,390 pounds, worth $18,723, and of cat-fish 708,260 pounds, worth $24,289. Drum amounted to 310,890 pounds, worth $11,356; suckers, 147,689 pounds, worth $5,266, and black bass, 142,352 pounds, worth $8,671. The yield of paddle-fish was 211,185 pounds, worth $4,657.

Nearly half of the catch in this State was taken with fyke nets. Other forms of apparatus with which large quantities of fish were secured were hand lines, seines, and trammel nets.

Table showing, by waters, the number of persons employed in the fisheries of Tennessee in 1899.

Waters.	Fisheries in which employed.							Shoresmen.	Total exclusive of duplication.
	Seines.	Fyke net.	Trammel net.	Line.	Shrimp trap.	Spear.	Grapnel.		
Cumberland River	.....	62	.....	62	.....	.....	.....	12	74
Tennessee River	.....	35	.....	97	.....	.....	.....	.....	97
Mississippi River	14	16	6	74	30	.....	.....	27	108
Reelfoot Lake	8	101	48	107	.....	32	53	12	164
Open and Number Nine lakes	11	8	5	.....	.....	.....	.....	1	15
Obion and Big Hatchie rivers	.....	18	.....	.....	.....	.....	.....	.....	18
Total	33	240	59	340	30	32	53	52	476

Table showing, by waters, the boats, apparatus, and property employed in the fisheries of Tennessee in 1899.

Waters and apparatus.	No.	Length (yards).	Value.	Waters and apparatus.	No.	Length (yards).	Value.
Cumberland River:				Reelfoot Lake—continued:			
Rowboats	62	.....	$310	Fyke nets	1,330	.....	$13,300
House boats	4	.....	205	Trammel nets	24	2,600	780
Fyke nets	369	.....	2,369	Set lines	248	49,600	496
Set lines	297	29,700	292	Hand lines	45	.....	48
Shore and accessory property	.....	.....	6,418	Spears	32	.....	112
Cash capital	.....	.....	15,000	Grapnels	53	.....	15
Tennessee River:				Shore and accessory property	.....	.....	4,885
Rowboats	101	.....	568	Open and Number Nine lakes:			
House boats	6	.....	330	Rowboats	10	.....	240
Fyke nets	216	.....	886	House boats	2	.....	100
Set lines	800	76,850	690	Seines	2	450	215
Mississippi River:				Fyke nets	75	.....	750
Rowboats	61	.....	1,255	Trammel nets	4	200	72
House boats	6	.....	340	Shore and accessory property	.....	.....	300
Gasoline launch	1	.....	1,000	Obion and Big Hatchie rivers:			
Seines	4	995	495	Rowboats	18	.....	180
Fyke nets	202	.....	1,010	Fyke nets	144	.....	640
Trammel nets	3	300	75	Shore and accessory property	.....	.....	350
Set lines	245	33,000	313				
Shrimp traps	600	.....	150	Total investment	.....	.....	92,883
Shore and accessory property	.....	.....	8,304				
Cash capital	.....	.....	27,000				
Reelfoot Lake:							
Rowboats	127	.....	2,540				
Seines	2	1,400	850				

Table showing, by waters and apparatus of capture, the yield of the fisheries of Tennessee in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	728	$44	80,700	$1,751	43,900	$947	5,330	$181
Reelfoot Lake	.....	.....	10,000	200	.....	.....	7,000	280
Open and Number Nine lakes	4,600	276	9,200	216	.....	.....	7,000	182
Total	5,328	320	99,900	2,167	43,900	947	19,330	643
Fyke nets:								
Cumberland River	1,784	197	15,349	1,128	1,634	129	23,390	1,865
Tennessee River	.....	.....	5,479	276	.....	.....	18,625	931
Mississippi River	560	34	50,088	1,323	2,600	72	9,100	415
Reelfoot Lake	14,100	846	323,000	4,685	25,300	281	50,000	1,161
Open and Number Nine lakes	1,000	60	7,500	225	.....	.....	6,000	240
Obion and Big Hatchie rivers	980	98	27,200	908	6,200	186	6,100	469
Total	18,424	1,235	428,616	8,545	35,734	668	113,215	5,081
Trammel nets:								
Mississippi River	.....	.....	12,000	240	4,500	90	2,000	60
Reelfoot Lake	5,400	324	114,000	1,770	.....	.....	66,000	383
Open and Number Nine lakes	200	12	4,300	129	.....	.....	1,200	48
Total	5,600	336	130,300	2,139	4,500	90	69,200	491
Lines:								
Cumberland River	.....	.....	21,183	1,590	2,820	170	32,740	2,472
Tennessee River	.....	.....	17,891	915	.....	.....	93,675	4,684
Mississippi River	.....	.....	102,300	2,254	.....	.....	131,600	4,718
Reelfoot Lake	113,000	6,780	.....	.....	.....	.....	159,500	3,825
Total	113,000	6,780	141,374	4,759	2,820	170	417,515	15,699
Spears:								
Reelfoot Lake	.....	.....	62,200	1,113	.....	.....	.....	.....
Grapnels:								
Reelfoot Lake	.....	.....	.....	.....	.....	.....	89,000	2,375
Total by waters:								
Cumberland River	1,784	197	36,532	2,718	4,454	299	56,130	4,337
Tennessee River	.....	.....	23,370	1,191	.....	.....	112,300	5,615
Mississippi River	1,288	78	245,088	5,568	51,000	1,109	148,030	5,374
Reelfoot Lake	132,500	7,950	509,200	7,768	25,300	281	371,500	8,024
Open and Number Nine lakes	5,800	348	21,000	570	.....	.....	14,200	470
Obion and Big Hatchie rivers	980	98	27,200	908	6,200	186	6,100	469
Grand total	142,352	8,671	862,390	18,723	86,954	1,875	708,260	24,289

Apparatus and waters.	Rock bass.		Pike perch (wall-eyed).		Pike perch (sauger).		Suckers.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	520	$32	380	$23	.....	.....	2,720	$33
Reelfoot Lake	.....	.....	.....	.....	.....	.....	1,500	15
Total	520	32	380	23	.....	.....	4,220	48
Fyke nets:								
Cumberland River	990	105	850	97	463	$41	9,400	781
Tennessee River	.....	.....	557	58	.....	.....	53,094	2,656
Mississippi River	435	26	520	31	.....	.....	2,315	44
Reelfoot Lake	.....	.....	1,100	57	.....	.....	22,000	220
Obion and Big Hatchie rivers	130	10	80	6	.....	.....	1,100	33
Total	1,555	141	3,107	249	463	41	87,909	3,734
Trammel nets:								
Reelfoot Lake	.....	.....	.....	.....	.....	.....	34,300	343
Lines:								
Tennessee River	.....	.....	6,030	474	.....	.....	21,260	1,141
Total by waters:								
Cumberland River	990	105	850	97	463	41	9,400	781
Tennessee River	.....	.....	6,587	532	.....	.....	74,354	3,797
Mississippi River	955	58	900	54	.....	.....	5,035	77
Reelfoot Lake	.....	.....	1,100	57	.....	.....	57,800	578
Obion and Big Hatchie rivers	130	10	80	6	.....	.....	1,100	33
Grand total	2,075	173	9,517	746	463	41	147,689	5,266

Table showing the yield of the fisheries of Tennessee in 1899—Continued.

Apparatus and waters.	Crappie.		Drum, fresh-water		Eels.		Hickory shad.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	1,700	$87	18,122	$194				
Reelfoot Lake	9,300	465	8,500	170				
Open and Number Nine lakes	8,100	335	5,100	92				
Total	19,100	887	31,722	456				
Fyke nets:								
Cumberland River	459	37	27,300	2,215				
Tennessee River			16,930	967			2,632	$133
Mississippi River	820	42	5,646	89	200	$4		
Reelfoot Lake	128,000	4,100	77,000	1,375				
Open and Number Nine lakes	500	25	2,200	44				
Obion and Big Hatchie rivers	3,400	308	7,600	267	50	2		
Total	133,179	4,512	136,676	4,957	250	6	2,632	133
Trammel nets:								
Mississippi River			3,000	30				
Reelfoot Lake	11,200	357	10,700	67				
Open and Number Nine lakes			3,200	64				
Total	11,200	357	16,900	161				
Lines:								
Cumberland River			30,694	2,180	1,420	104		
Tennessee River			59,903	3,277			3,943	225
Mississippi River			21,895	251	5,510	171		
Reelfoot Lake			13,100	74	7,000	167		
Total			125,592	5,782	13,930	442	3,943	225
Total by waters:								
Cumberland River	459	37	57,994	4,395	1,420	104		
Tennessee River			76,833	4,244			6,575	358
Mississippi River	2,520	129	48,663	564	5,710	175		
Reelfoot Lake	148,500	4,922	109,300	1,686	7,000	167		
Open and Number Nine lakes	8,600	360	10,500	200				
Obion and Big Hatchie rivers	3,400	308	7,600	267	50	2		
Grand total	163,479	5,756	310,890	11,356	14,180	448	6,575	358

Apparatus and waters.	Paddle-fish.		Sturgeon, lake.		Sturgeon, shovel-nose.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:						
Mississippi River	18,500	$475			400	$12
Reelfoot Lake	65,000	1,300				
Open and Number Nine lakes	40,000	1,200				
Total	123,500	2,975			400	12
Fyke nets:						
Cumberland River	6,540	328	5,010	$431	2,803	152
Tennessee River			5,290	265		
Mississippi River	2,445	73	280	8	1,405	42
Reelfoot Lake	78,000	1,260				
Obion and Big Hatchie rivers	700	21				
Total	87,685	1,682	10,580	704	4,208	194
Lines:						
Cumberland River					2,500	250
Tennessee River					24,570	988
Mississippi River					720	22
Total					27,790	1,260
Total by waters:						
Cumberland River	6,540	328	5,010	431	5,303	402
Tennessee River			5,290	265	24,570	988
Mississippi River	20,945	548	280	8	2,525	76
Reelfoot Lake	143,000	2,560				
Open and Number Nine lakes	40,000	1,200				
Obion and Big Hatchie rivers	700	21				
Grand total	211,185	4,657	10,580	704	32,398	1,466

Table showing the yield of the fisheries of Tennessee in 1899—Continued.

Apparatus and waters.	Sun-fish.		Yellow perch.		Shrimp.		Turtles.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	300	$15					2,200	$49
Open and Number Nine lakes.	1,200	36					600	12
Total	1,500	51					2,800	61
Fyke nets:								
Cumberland River	2,068	190	705	$44				
Mississippi River							1,210	33
Reelfoot Lake	31,200	781						
Open and Number Nine lakes.	700	35						
Obion and Big Hatchie rivers.	1,200	60						
Total	35,168	1,066	705	44			1,210	33
Lines:								
Mississippi River							4,150	83
Shrimp traps:								
Mississippi River					20,040	$1,670		
Total by waters:								
Cumberland River	2,068	190	705	44				
Mississippi River	300	15			20,040	1,670	7,560	165
Reelfoot Lake	31,200	781						
Open and Number Nine lakes.	1,900	71					600	12
Obion and Big Hatchie rivers.	1,200	60						
Grand total	36,668	1,117	705	44	20,040	1,670	8,160	177

Summary, by apparatus and waters, of the fisheries of Tennessee in 1899.

Apparatus and waters.	Lbs.	Value.
Seines:		
Mississippi River	175,500	$3,843
Reelfoot Lake	101,300	2,430
Open and Number Nine lakes.	75,800	2,349
Total	352,600	8,622
Fyke nets:		
Cumberland River	98,745	7,740
Tennessee River	102,607	5,286
Mississippi River	77,624	2,236
Reelfoot Lake	749,700	14,766
Open and Number Nine lakes.	17,900	629
Obion and Big Hatchie rivers.	54,740	2,368
Total	1,101,316	33,025
Trammel nets:		
Mississippi River	21,500	420
Reelfoot Lake	241,600	3,244
Open and Number Nine lakes.	8,900	253
Total	272,000	3,917

Apparatus and waters.	Lbs.	Value.
Lines:		
Cumberland River	91,357	$6,766
Tennessee River	227,272	11,704
Mississippi River	266,175	7,499
Reelfoot Lake	292,600	10,846
Total	877,404	36,815
Shrimp traps:		
Mississippi River	20,040	1,670
Spears:		
Reelfoot Lake	62,200	1,113
Grapnels:		
Reelfoot Lake	89,000	2,375
Total by waters:		
Cumberland River	190,102	14,506
Tennessee River	329,879	16,990
Mississippi River	560,839	15,668
Reelfoot Lake	1,536,400	34,774
Open and Number Nine lakes.	102,600	3,231
Obion and Big Hatchie rivers.	54,740	2,368
Grand total	2,774,560	87,537

Table showing the extent of the wholesale trade in fishery products in Tennessee in 1899.

Items.	Union City and Bluebank.		Memphis.		Total.	
	No.	Value.	No.	Value.	No.	Value.
Establishments	3	$3,925	3	$4,175	6	$8,100
Cash capital		15,500		11,500		27,000
Wages paid		5,200		4,356		9,556
Persons engaged	15		11		26	
Total investment		24,625		20,031		44,656
Products sold:						
Fresh fish ..... pounds..	1,240,000	67,950	680,000	43,050	1,920,000	111,000
Oysters ..... gallons..	260	338	500	650	760	988
Value of products		68,288		43,700		111,988

ALABAMA.

The fisheries of Alabama here considered are only those of the Tennessee River within that State. In 1899 68 persons were engaged in these fisheries, and the investment was $4,463. Of this amount, $2,233 represented the value of fyke nets. The products amounted to 852,460 pounds, valued at $42,588. The principal species taken were cat-fish, 233,580 pounds, worth $11,691; fresh-water drum, 224,060 pounds, worth $11,153; hickory shad, 158,480 pounds, worth $7,924; suckers, 124,800 pounds, worth $6,241.

More than half of the catch of fish was taken with wooden traps, of which 47 were in use, worth $705.

Table showing the number of persons employed in the fisheries of Alabama in 1899.

Fisheries in which employed.	No.
Set line	62
Fyke net	60
Wooden trap	6
Total, exclusive of duplication	68

Table showing the boats and apparatus of capture employed in the fisheries of Alabama in 1899.

Items.	No.	Value.
Fishing boats	87	$374
House boats	22	700
Set lines	540	451
Fyke nets	526	2,233
Wooden traps	47	705
Total investment	.....	4,463

Table showing, by apparatus of capture, the yield of the fisheries of Alabama in 1899.

Species.	Set lines.		Fyke nets.		Wooden traps.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	4,960	$248	5,280	$264	.....	.....	10,240	$512
Buffalo-fish	21,400	1,070	23,780	1,189	28,200	$1,410	73,380	3,669
Cat-fish	27,910	1,407	27,070	1,354	178,600	8,930	233,580	11,691
Drum, fresh-water	25,900	1,295	28,960	1,398	169,200	8,460	224,060	11,153
Eels	5,070	254	2,970	149	.....	.....	8,040	403
Hickory shad	12,660	633	14,220	711	131,600	6,580	158,480	7,924
Pike perch (wall-eyed)	3,390	170	4,410	221	.....	.....	7,800	391
Sturgeon, lake	.....	.....	4,480	224	.....	.....	4,480	224
Sturgeon, shovel-nose	7,600	380	.....	.....	.....	.....	7,600	380
Suckers	16,170	809	52,230	2,612	56,400	2,820	124,800	6,241
Total	125,060	6,266	163,400	8,122	564,000	28,200	852,460	42,588

MISSISSIPPI.

In Mississippi in 1899 the fisheries in the waters of the Mississippi River and tributaries gave employment to 546 persons, with an investment of $43,371. The products amounted to 3,920,942 pounds, valued at $97,711. The leading species was buffalo-fish, the catch of which was 2,023,230 pounds, worth $33,747. Cat-fish, drum, paddle-fish, and shrimp were also taken in considerable quantities. The yield of caviar from the roe of paddle-fish was 32,775 pounds, valued at $14,391.

The greater part of the products in this State was derived from the Mississippi and Yazoo rivers. Fyke nets and seines were the most important forms of apparatus used, the former being valued at $11,715 and the latter at $4,945.

Table showing, by waters, the number of persons employed in fisheries of Mississippi in 1899.

Waters.	Fisheries in which employed.							Shoresmen.	Total, exclusive of duplication.
	Seine.	Trammel net.	Fyke net.	Pound net.	Set line.	Drift line.	Shrimp trap.		
Mississippi River	46	4	57	3	90	22	147	25	265
Yazoo River	2	.....	120	.....	78	.....	.....	11	150
Lake Horn	10	.....	.....	.....	.....	.....	.....	.....	10
Lake Moon	16	.....	.....	.....	.....	.....	.....	3	19
Miscellaneous waters	62	8	5	.....	17	.....	.....	12	96
Total	136	12	182	3	185	22	147	51	540

Table showing, by waters, the boats, apparatus, and capital employed in the fisheries of Mississippi in 1899.

Waters.	Fishing boats.		House boats.		Seines.			Fyke nets.	
	No.	Value.	No.	Value.	No.	Yards.	Value.	No.	Value.
Mississippi River	*214	$6,250	24	$1,695	15	2,025	$1,040	645	$3,225
Yazoo River	104	2,060	5	250	.....	.....	.....	1,390	8,340
Lake Horn	5	200	.....	.....	1	800	400	.....	.....
Lake Moon	10	1,650	.....	.....	2	1,600	800	.....	.....
Miscellaneous waters	50	2,015	.....	.....	13	5,350	2,705	30	150
Total	383	12,175	29	1,945	31	9,875	4,945	2,065	11,715

Waters.	Trammel nets.			Pound nets.		Set lines.			Drift lines.	
	No.	Yards.	Value.	No.	Value.	No.	Yards.	Value.	No.	Value.
Mississippi River	2	200	$60	1	$50	406	40,600	$524	640	$32
Yazoo River	.....	.....	.....	.....	.....	732	73,200	915	.....	.....
Miscellaneous waters	4	400	110	.....	.....	80	9,200	92	.....	.....
Total	6	600	170	1	50	1,218	123,000	1,531	640	32

Waters.	Shrimp traps.		Otter traps.		Shore and accessory property.	Cash capital.	Total investment.
	No.	Value.	No.	Value.			
Mississippi River	2,800	$541	.....	.....	$1,583	$4,200	$19,200
Yazoo River	.....	.....	40	$13	1,111	.....	12,689
Lake Horn	.....	.....	.....	.....	125	.....	725
Lake Moon	.....	.....	.....	.....	2,000	.....	4,450
Miscellaneous waters	.....	.....	.....	.....	1,235	.....	6,307
Total	2,800	541	40	13	6,054	4,200	43,371

*Includes one vessel of 13 tons, valued at $1,400, and two gasoline launches, valued at $1,200.

Table showing, by waters and apparatus of capture, the yield of the fisheries of Mississippi in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:						
Mississippi River	2,015	$121	212,400	$3,628	900	$17
Lake Horn	300	21	20,000	400	.....	.....
Lake Moon	.....	.....	624,000	9,360	.....	.....
Miscellaneous waters	2,983	179	194,400	3,718	5,300	98
Total	5,298	321	1,050,800	17,106	6,200	115
Trammel nets:						
Mississippi River	.....	.....	1,800	36	.....	.....
Miscellaneous waters	2,900	174	28,000	560	.....	.....
Total	2,900	174	29,800	596	.....	.....
Fyke nets:						
Mississippi River	2,500	150	242,200	4,895	3,010	47
Yazoo River	1,600	80	631,000	9,465	1,615	32
Miscellaneous waters	480	29	19,000	570	.....	.....
Total	4,580	259	892,200	14,930	4,625	79
Pound nets:						
Mississippi River	100	6	10,000	300	.....	.....
Set lines:						
Mississippi River	.....	.....	37,300	754	.....	.....
Yazoo River	.....	.....	1,590	24	.....	.....
Miscellaneous waters	.....	.....	1,540	37	.....	.....
Total	.....	.....	40,430	815	.....	.....
Total by waters:						
Mississippi River	4,615	277	503,700	9,613	3,910	64
Yazoo River	1,600	80	632,590	9,489	1,615	32
Lake Horn	300	21	20,000	400	.....	.....
Lake Moon	.....	.....	624,000	9,360	.....	.....
Miscellaneous waters	6,363	382	242,940	4,885	5,300	98
Grand total	12,878	760	2,023,230	33,747	10,825	194

Apparatus and waters.	Eels.		Pike and pickerel.		Pike perch (wall-eyed).		Rock bass.		Sturgeon, shovel-nose.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Mississippi River	.....	.....	.....	.....	190	$12	2,016	$118	400	$6
Lake Horn	.....	.....	350	$25	.....	.....	500	35	.....	.....
Miscellaneous waters	.....	.....	.....	.....	.....	.....	4,875	230	.....	.....
Total	.....	.....	350	25	190	12	7,391	383	400	6
Fyke nets:										
Mississippi River	.....	.....	.....	.....	926	59	4,600	212	3,100	35
Yazoo River	.....	.....	.....	.....	.....	.....	2,320	110	.....	.....
Miscellaneous waters	.....	.....	.....	.....	.....	.....	209	13	.....	.....
Total	.....	.....	.....	.....	926	59	7,129	335	3,100	35
Trammel nets:										
Mississippi River	.....	.....	.....	.....	.....	.....	250	10	.....	.....
Pound nets:										
Mississippi River	.....	.....	.....	.....	100	6	.....	.....	.....	.....
Set lines:										
Mississippi River	2,180	$15	.....	.....	.....	.....	.....	.....	5,100	59
Yazoo River	1,365	41	.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous waters	385	12	.....	.....	.....	.....	.....	.....	.....	.....
Total	3,930	68	.....	.....	.....	.....	.....	.....	5,100	59
Total by waters:										
Mississippi River	2,180	15	.....	.....	1,216	77	6,866	340	8,600	100
Yazoo River	1,365	41	350	25	.....	.....	2,320	110	.....	.....
Lake Horn	.....	.....	.....	.....	.....	.....	500	35	.....	.....
Miscellaneous waters	385	12	.....	.....	.....	.....	5,084	243	.....	.....
Grand total	3,930	68	350	25	1,216	77	14,770	728	8,600	100

Table showing the yield of the fisheries of Mississippi in 1899—Continued.

Apparatus and waters.	Cat-fish.		Crappie.		Drum, fresh-water.		Paddle-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	4,955	$196	10,000	$594	13,200	$213	100,500	$2,391
Lake Horn	3,800	152	6,000	420	7,000	140	26,000	780
Lake Moon	2,600	104	.....	.....	1,200	18	200,000	4,000
Miscellaneous waters	12,200	425	14,500	698	24,900	396	266,600	5,270
Total	23,555	877	30,500	1,712	46,300	767	593,100	12,441
Trammel nets:								
Mississippi River	700	28	.....	.....	1,500	23	400	10
Miscellaneous waters	6,000	280	5,800	290	3,400	68	12,000	360
Total	6,700	308	5,800	290	4,900	91	12,400	370
Fyke nets:								
Mississippi River	14,545	576	2,515	128	37,200	579	15,205	340
Yazoo River	23,200	696	2,050	94	88,000	1,325	327,000	3,570
Miscellaneous waters	300	15	1,100	66	800	16	600	18
Total	38,045	1,287	5,665	288	126,000	1,920	342,805	3,928
Pound nets:								
Mississippi River	1,400	70	.....	.....	1,200	24	.....	.....
Drift lines:								
Miscellaneous waters	19,200	711	.....	.....	.....	.....	.....	.....
Set lines:								
Mississippi River	194,000	7,160	.....	.....	15,120	250	.....	.....
Yazoo River	84,700	2,541	.....	.....	3,520	53	.....	.....
Miscellaneous waters	29,700	1,348	.....	.....	1,250	25	.....	.....
Total	308,400	11,049	.....	.....	19,890	328	.....	.....
Total by waters:								
Mississippi River	234,800	8,741	12,515	722	68,220	1,089	116,105	2,741
Yazoo River	107,900	3,237	2,050	94	91,520	1,378	327,000	3,570
Lake Horn	3,800	152	6,000	420	7,000	140	26,000	780
Lake Moon	2,600	104	.....	.....	1,200	18	200,000	4,000
Miscellaneous waters	48,200	2,068	21,400	1,054	30,350	505	279,200	5,648
Grand total	397,300	14,302	41,965	2,290	198,290	3,130	948,305	16,739

Apparatus and waters.	Suckers.		Shrimp.		Turtles.		Caviar.		Otter skins.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Mississippi River	4,900	$76	.....	.....	.....	.....	1,750	$613	.....	.....
Lake Horn	2,400	48	.....	.....	.....	.....	500	100	.....	.....
Lake Moon	700	11	.....	.....	.....	.....	15,875	9,525	.....	.....
Miscellaneous waters	7,200	178	.....	.....	.....	.....	14,250	4,013	.....	.....
Total	15,200	313	.....	.....	.....	.....	32,375	14,251	.....	.....
Trammel nets:										
Mississippi River	.....	.....	.....	.....	100	$2	.....	.....	.....	.....
Fyke nets:										
Mississippi River	23,060	353	.....	.....	800	16	.....	.....	.....	.....
Yazoo River	65,900	989	.....	.....	.....	.....	400	140	.....	.....
Miscellaneous waters	1,300	26	.....	.....	.....	.....	.....	.....	.....	.....
Total	90,260	1,368	.....	.....	800	16	400	140	.....	.....
Pound nets:										
Mississippi River	300	6	.....	.....	.....	.....	.....	.....	.....	.....
Shrimp traps:										
Mississippi River	.....	.....	119,838	$9,430	.....	.....	.....	.....	.....	.....
Otter traps:										
Yazoo River	.....	.....	.....	.....	.....	.....	.....	.....	10	$25
Total by waters:										
Mississippi River	28,260	435	119,838	9,430	900	18	1,750	613	.....	.....
Yazoo River	65,900	989	.....	.....	.....	.....	400	140	10	25
Lake Horn	2,400	48	.....	.....	.....	.....	500	100	.....	.....
Lake Moon	700	11	.....	.....	.....	.....	15,875	9,525	.....	.....
Miscellaneous waters	8,500	204	.....	.....	.....	.....	14,250	4,013	.....	.....
Grand total	105,760	1,687	119,838	9,430	900	18	32,775	14,391	10	25

Summary, by apparatus and waters, of the fisheries of Mississippi in 1899.

Apparatus and waters.	Lbs.	Value.	Apparatus and waters.	Lbs.	Value.
Seines:			Set lines:		
Mississippi River	353,226	$7,985	Mississippi River	253,700	$8,238
Lake Horn	66,850	2,121	Yazoo River	91,175	2,659
Lake Moon	844,375	23,018	Miscellaneous waters	32,875	1,422
Miscellaneous waters	547,208	15,205	Total	377,750	12,319
Total	1,811,659	48,329	Drift lines:		
Trammel nets:			Mississippi River	19,200	711
Mississippi River	4,750	109	Shrimp traps:		
Miscellaneous waters	58,100	1,732	Mississippi River	119,838	9,430
Total	62,850	1,841	Otter traps:		
Fyke nets;			Yazoo River	10	25
Mississippi River	349,661	7,390	Total by waters:		
Yazoo River	1,143,085	16,501	Mississippi River	1,113,475	34,275
Miscellaneous waters	23,789	753	Yazoo River	1,234,620	19,210
Total	1,516,535	24,644	Lake Horn	66,500	2,096
Pound nets:			Lake Moon	844,375	23,018
Mississippi River	13,100	412	Miscellaneous waters	661,972	19,112
			Grand total	3,920,942	97,711

LOUISIANA.

The fisheries of Louisiana in the Mississippi River and tributaries are unimportant in comparison to the coast fisheries of the State. The persons employed numbered 326, the amount of capital invested was $18,745, and the yield of all species was 1,942,185 pounds, valued at $57,072. The waters from which the largest quantity of products was derived were the Red River, 629,350 pounds, $16,322; Mississippi River, 446,857 pounds, $16,542; Black River, 161,816 pounds, $4,782; and the Ouachita River, 145,460 pounds, $3,745. The apparatus of capture consisted chiefly of lines, fyke nets, and seines. The species taken in greatest abundance were buffalo-fish and cat-fish, the catch of the former being 799,320 pounds, worth $15,655, and of the latter 682,347 pounds, worth $22,373. Other important species were fresh-water drum, crappie, black bass, and paddle-fish or spoon-bill cat.

Table showing, by waters, the number of persons employed in fisheries of Louisiana in 1899.

Waters.	Fisheries in which employed.								Shoresmen.	Total exclusive of duplication.
	Seine.	Fyke net.	Trammel net.	Cast net.	Set line.	Wooden fish trap.	Shrimp trap.	Alligator, terrapin, and otter hunters.		
Fausse River	10									10
Black River		6			15			6		18
Mississippi River		55			88		64	17	1	143
Ouachita River		16			12			5		21
Red River		43		25	68					68
Lake Black Fork	7									7
Lake Centennial	2									2
Lake Concordia	12		2							14
Lake Old River	8									8
Lake Palmyra	12								1	13
Lake Bistineau		2			2	4				4
Lake Catahoula					10					10
Lake Cross			2		8					8
Total	51	122	4	25	203	4	64	28	2	326

Table showing, by waters, the boats, apparatus, and property employed in the fisheries of Louisiana in 1899.

Waters.	Fishing boats.		House boats.		Seines.			Fyke nets.	
	No.	Value.	No.	Value.	No.	Length (yards).	Value.	No.	Value.
Fausse River	4	$120			3	450	$250		
Black River	18	345						48	$240
Mississippi River	132	2,570	14	$770				331	1,665
Ouachita River	17	240	2	120				180	900
Red River	77	3,239	41	1,150				169	816
Lake Black Fork	3	90			2	300	150		
Lake Centennial	1	15			1	80	30		
Lake Concordia	7	300			3	450	260		
Lake Old River	4	160			2	600	350		
Lake Palmyra	5	250			2	1,000	500		
Lake Bistineau	4	35						12	48
Lake Catahoula	10	200							
Lake Cross	8	80							
Total	290	7,644	57	2,040	13	2,880	1,540	740	3,669

Waters.	Trammel nets.			Wooden fish traps.		Shrimp traps.	
	No.	Length (yards).	Value.	No.	Value.	No.	Value.
Mississippi River						1,746	$263
Lake Concordia	1	120	$30				
Lake Bistineau				2	$275		
Lake Cross	1	120	30				

Waters.	Set lines.		Guns.		Otter traps.		Shore and accessory property.	Total investment.
	No.	Value.	No.	Value.	No.	Value.		
Fausse River							$160	$530
Black River	75	$112	3	$60	96	$28	10	795
Mississippi River	419	515	15	300	48	14	158	6,255
Ouachita River	48	60			120	35	95	1,450
Red River	331	317					900	6,422
Lake Black Fork							80	320
Lake Centennial								45
Lake Concordia							45	635
Lake Old River							55	565
Lake Palmyra							180	930
Lake Bistineau	2	2					2	362
Lake Catahoula	50	68					45	313
Lake Cross	8	8					5	123
Total	933	1,082	18	360	264	77	1,735	18,745

Table showing, by waters and apparatus of capture, the yield of the fisheries of Louisiana in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Fausse River	7,200	$360	29,000	$580			872	$35
Lake Black Fork	3,800	190	13,500	270	85	$2	400	16
Lake Centennial	145	9	6,000	120			600	24
Lake Concordia	1,400	84	54,000	1,080			950	29
Lake Old River	1,200	72	52,000	780			3,000	120
Lake Palmyra			58,000	870	200	3	2,350	94
Total	13,745	715	212,500	3,700	285	5	8,172	318
Fyke nets:								
Black River	1,600	96	37,000	740			600	18
Mississippi River	790	47	122,400	2,029	860	15	7,025	268
Ouachita River	1,200	72	80,000	1,600			5,400	195
Red River			24,000	810			268,000	8,043
Lake Bistineau	1,000	100	1,500	53	1,000	150	500	30
Total	4,590	315	264,900	5,232	1,860	165	281,525	8,554
Trammel nets:								
Lake Concordia	300	18	6,900	138			1,000	30
Wooden fish-traps:								
Lake Bistineau	1,000	100	45,000	1,575			1,000	60

Table showing the yield of the fisheries of Louisiana in 1899—Continued.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Lines:								
Black River	.....	.....	18,000	$360	.....	.....	92,000	$2,760
Mississippi River	.....	.....	17,570	332	.....	.....	175,300	6,715
Ouachita River	.....	.....	950	19	.....	.....	28,000	840
Red River	.....	.....	229,000	4,142	.....	.....	35,250	1,090
Lake Bistineau	100	$10	500	17	500	$75	100	6
Lake Catahoula	.....	.....	.....	.....	.....	.....	52,000	1,560
Lake Cross	3,000	270	4,000	140	.....	.....	8,000	440
Total	3,100	280	270,020	5,010	500	75	390,650	13,411
Total by waters:								
Fausse River	7,200	360	29,000	580	.....	.....	872	35
Black River	1,600	96	55,000	1,100	.....	.....	92,600	2,778
Mississippi River	790	47	139,970	2,361	860	15	182,325	6,983
Ouachita River	1,200	72	80,950	1,619	.....	.....	33,400	1,035
Red River	.....	.....	253,000	4,952	.....	.....	303,250	9,133
Lake Black Fork	3,800	190	13,500	270	85	2	400	16
Lake Centennial	145	9	6,000	120	.....	.....	600	24
Lake Concordia	1,700	102	60,900	1,218	.....	.....	1,950	59
Lake Old River	1,200	72	52,000	780	.....	.....	3,000	120
Lake Palmyra	.....	.....	58,000	870	200	3	2,350	94
Lake Bistineau	2,100	210	47,000	1,645	1,500	225	1,600	96
Lake Catahoula	.....	.....	.....	.....	.....	.....	52,000	1,560
Lake Cross	3,000	270	4,000	140	.....	.....	8,000	440
Grand total	22,735	1,428	799,320	15,655	2,645	245	682,347	22,373

Apparatus and waters.	Crappie.		Drum, fresh-water.		Eels.		Paddle-fish.		White bass.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Value.	Lbs.	Val.
Seines:										
Fausse River	8,365	$418	1,900	$38	.....	.....	12,000	$240	.....	.....
Lake Black Fork	4,200	210	2,000	40	.....	.....	6,000	120	.....	.....
Lake Centennial	300	18	900	18	.....	.....	800	16	.....	.....
Lake Concordia	2,700	162	3,900	59	.....	.....	25,000	375	.....	.....
Lake Old River	5,800	290	7,200	108	.....	.....	37,000	555	.....	.....
Lake Palmyra	.....	.....	4,000	60	.....	.....	40,000	400	.....	.....
Total	21,365	1,098	19,900	323	.....	.....	120,800	1,706	.....	.....
Lines:										
Black River	.....	.....	1,400	21	260	$8	.....	.....	.....	.....
Mississippi River	.....	.....	13,010	247	1,410	45	.....	.....	.....	.....
Ouachita River	.....	.....	9,400	188	.....	.....	.....	.....	.....	.....
Red River	.....	.....	44,100	1,669	.....	.....	.....	.....	.....	.....
Lake Bistineau	200	20	.....	.....	.....	.....	.....	.....	50	$5
Lake Cross	12,000	1,080	.....	.....	.....	.....	.....	.....	3,000	270
Total	12,200	1,100	67,910	2,125	1,670	53	.....	.....	3,050	275
Fyke nets:										
Black River	2,900	174	2,000	30	.....	.....	.....	.....	.....	.....
Mississippi River	1,335	76	18,185	291	.....	.....	10,200	230	.....	.....
Ouachita River	2,600	156	13,600	272	.....	.....	1,200	24	.....	.....
Red River	.....	.....	28,700	553	.....	.....	.....	.....	.....	.....
Lake Bistineau	800	80	.....	.....	.....	.....	.....	.....	100	10
Total	7,635	486	62,485	1,146	.....	.....	11,400	254	100	10
Trammel nets:										
Lake Concordia	700	42	500	8	.....	.....	.....	.....	.....	.....
Wooden fish-traps:										
Lake Bistineau	1,000	100	.....	.....	.....	.....	.....	.....	.....	.....
Total by waters:										
Fausse River	8,365	418	1,900	38	.....	.....	12,000	240	.....	.....
Black River	2,900	174	3,400	51	260	8	.....	.....	.....	.....
Mississippi River	1,335	76	31,195	538	1,410	45	10,200	230	.....	.....
Ouachita River	2,600	156	23,000	460	.....	.....	1,200	24	.....	.....
Red River	.....	.....	72,800	2,222	.....	.....	.....	.....	.....	.....
Lake Black Fork	4,200	210	2,000	40	.....	.....	6,000	120	.....	.....
Lake Centennial	300	18	900	18	.....	.....	800	16	.....	.....
Lake Concordia	3,400	204	4,400	67	.....	.....	25,000	375	.....	.....
Lake Old River	5,800	290	7,200	108	.....	.....	37,000	555	.....	.....
Lake Palmyra	.....	.....	4,000	60	.....	.....	40,000	400	.....	.....
Lake Bistineau	2,000	200	.....	.....	.....	.....	.....	.....	150	15
Lake Cross	12,000	1,080	.....	.....	.....	.....	.....	.....	3,000	270
Grand total	42,900	2,826	150,795	3,602	1,670	53	132,200	1,960	3,150	285

Table showing the yield of the fisheries of Louisiana in 1899—Continued.

Apparatus and waters.	Pike.		Pike perch (wall-eyed).		Rock bass.		Suckers.		Caviar.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Fausse River					1,500	$75	600	$12		
Lake Black Fork					1,200	60	300	6		
Lake Centennial					200	12				
Lake Concordia					1,800	108	1,110	17	625	$219
Lake Old River					1,000	50	2,700	41	1,625	406
Lake Palmyra							1,800	34	1,500	375
Total					5,700	305	6,510	110	3,750	1,000
Lines:										
Red River							300	15		
Fyke nets:										
Black River					1,400	84	3,400	51		
Mississippi River			50	$3	2,790	163	18,340	279		
Ouachita River	300	$18			800	48				
Total	300	18	50	3	4,990	295	21,740	330		
Trammel nets:										
Lake Concordia					225	14				
Total by waters:										
Fausse River					1,500	75	600	12		
Black River					1,400	84	3,400	51		
Mississippi River			50	3	2,790	163	18,340	279		
Ouachita River	300	18			800	48				
Red River							300	15		
Lake Black Fork					1,200	60	300	6		
Lake Centennial					200	12				
Lake Concordia					2,025	122	1,110	17	625	219
Lake Old River					1,000	50	2,700	41	1,625	406
Lake Palmyra							1,800	34	1,500	375
Grand total	300	18	50	3	10,915	614	28,550	455	3,750	1,000

Apparatus and waters.	Shrimp.		Turtles.		Alligator hides.		Otter skins.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Lines:								
Ouachita River			1,400	$28				
Fyke nets:								
Mississippi River			680	14				
Ouachita River			500	10				
Total			1,180	24				
Shrimp traps:								
Mississippi River	52,980	$4,395						
Otter traps:								
Black River							56	$140
Mississippi River							182	455
Ouachita River							110	275
Total							348	870
Guns:								
Black River					1,200	$300		
Mississippi River					3,750	938		
Total					4,950	1,238		
Total by waters:								
Black River					1,200	300	56	140
Mississippi River	52,980	4,395	680	14	3,750	938	182	455
Ouachita River			1,900	38			110	275
Grand total	52,980	4,395	2,580	52	4,950	1,238	348	870

Summary, by apparatus and waters, of the fisheries of Louisiana in 1899.

Apparatus and waters.	Lbs.	Value.
Seines:		
Fausse River	61,437	$1,758
Lake Black Fork	31,485	914
Lake Centennial	8,945	217
Lake Concordia	91,485	2,133
Lake Old River	111,525	2,422
Lake Palmyra	107,850	1,836
Total	412,727	9,280
Lines:		
Black River	111,660	3,149
Mississippi River	207,290	7,339
Ouachita River	39,750	1,075
Red River	308,650	6,916
Lake Bistineau	1,450	133
Lake Catahoula	52,000	1,560
Lake Cross	30,000	2,200
Total	750,800	22,372
Fyke nets:		
Black River	48,900	1,193
Mississippi River	182,655	3,415
Ouachita River	105,600	2,395
Red River	320,700	9,406
Lake Bistineau	4,900	423
Total	662,755	16,832
Trammel nets:		
Lake Concordia	9,625	250
Wooden fish-traps:		
Lake Bistineau	48,000	1,835
Shrimp traps:		
Mississippi River	52,980	$4,395
Otter traps:		
Black River	56	140
Mississippi River	182	455
Ouachita River	110	275
Total	348	870
Guns:		
Black River	1,200	300
Mississippi River	3,750	938
Total	4,950	1,238
Total by waters:		
Fausse River	61,437	1,758
Black River	161,816	4,782
Mississippi River	446,857	16,542
Ouachita River	145,460	3,745
Red River	629,350	16,322
Lake Black Fork	31,485	914
Lake Centennial	8,945	217
Lake Concordia	101,110	2,383
Lake Old River	111,525	2,422
Lake Palmyra	107,850	1,836
Lake Bistineau	54,350	2,391
Lake Catahoula	52,000	1,560
Lake Cross	30,000	2,200
Grand total	1,942,185	57,072

ARKANSAS.

The commercial fisheries of Arkansas are prosecuted wholly in the Mississippi River and its tributaries. Some of the more important tributaries of the Mississippi in this State are the Arkansas, White, St. Francis, and Ouachita rivers, and Big Lake. Large quantities of fishery products are also derived from other waters.

In 1899 the number of persons employed in the fisheries was 463. The capital invested in boats, apparatus of capture, and fishing property amounted to $39,105. The boats, including house boats, numbered 437, valued at $10,357. The fishing apparatus was valued at $25,147, and the shore and accessory property at $3,601.

The products aggregated 4,896,591 pounds, valued at $168,071. The principal species obtained were buffalo-fish, 2,388,890 pounds, $52,521; cat-fish, 838,514 pounds, $42,044; fresh-water drum, 304,105 pounds, $7,848. Black bass, crappie, paddle-fish, sun-fish, frogs, and various other species were taken in considerable quantities. Caviar made from the roe of the paddle-fish or spoon-bill cat amounted to 34,175 pounds, valued at $11,488.

The most productive forms of fishing apparatus were seines and fyke nets, the catch with the former being 2,036,582 pounds, valued at $62,505, and with the latter 1,404,613 pounds, valued at $14,664. Next in importance, with respect to the quantity and value of products, were pound nets, trammel nets, and set lines.

Table showing, by waters, the number of persons employed in the fisheries of Arkansas in 1899.

Waters.	Fisheries in which employed.								Shoresmen.	Total, exclusive of duplication.
	Seine.	Pound net.	Trammel net.	Fyke net.	Set line.	Miscellaneous line.	Spear.	Otter trap and gun.		
Arkansas River	17	2	3	50	42	.....	.....	.....	.....	56
White River	18	2	15	72	73	.....	.....	.....	.....	84
St. Francis River	6	12	32	54	34	8	70	86	8	122
Ouachita River	7	.....	6	16	20	.....	.....	.....	.....	20
Cache River	4	.....	4	8	8	.....	.....	.....	.....	8
Mississippi River	30	.....	2	32	31	5	.....	10	17	54
Horseshoe and Porter lakes	10	.....	.....	3	.....	.....	.....	.....	.....	13
Big Lake	17	8	16	15	15	20	20	24	.....	27
Miscellaneous waters	72	.....	2	14	6	6	.....	.....	7	79
Total	181	24	80	264	229	39	90	120	32	463

Table showing, by waters, the apparatus employed in the fisheries of Arkansas in 1899.

Waters.	Fishing boats.		House boats.		Seines.			Pound nets.		Drag nets.	
	No.	Value.	No.	Value.	No.	Length (yards).	Value.	No.	Value.	No.	Value.
Arkansas River	60	$1,018	4	$380	6	1,710	$572	1	$35	.....	.....
White River	102	651	15	275	8	920	475	1	40	.....	.....
St. Francis River	102	2,820	10	465	2	300	150	8	400	.....	.....
Ouachita River	15	110	1	35	.....	.....	.....	.....	.....	20	$160
Cache River	5	38	2	40	2	240	100	.....	.....	.....	.....
Mississippi River	44	1,975	10	465	9	1,750	880	.....	.....	.....	.....
Horseshoe and Porter lakes	7	240	2	125	1	800	400	.....	.....	.....	.....
Big Lake	27	540	.....	.....	7	980	450	6	300	.....	.....
Miscellaneous waters	31	1,180	.....	.....	13	6,405	3,235	.....	.....	.....	.....
Total	393	8,572	44	1,785	48	13,105	6,262	16	775	20	160

Waters.	Trammel nets.			Fyke nets.		Set lines.		Miscellaneous lines.	
	No.	Length (yards).	Value.	No.	Value.	No.	Value.	No.	Value.
Arkansas River	7	140	$42	247	$1,099	75	$92	.....	.....
White River	25	1,505	625	525	2,764	628	528	.....	.....
St. Francis River	16	1,925	405	925	4,625	141	127	8	$10
Ouachita River	40	1,400	320	29	145	145	138	.....	.....
Cache River	2	150	70	50	340	42	35	.....	.....
Mississippi River	1	100	25	272	1,360	137	183	162	23
Horseshoe and Porter lakes	.....	.....	.....	90	900	.....	.....	.....	.....
Big Lake	8	1,200	320	300	1,500	60	35	20	20
Miscellaneous waters	3	310	90	138	1,080	24	15	6	8
Total	102	6,730	1,897	2,576	13,813	1,252	1,153	196	61

Waters.	Spears.		Otter traps.		Guns.		Shrimp traps.		Shore and accessory property.	Total investment.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.		
Arkansas River	.....	.....	.....	.....	.....	.....	.....	.....	52	$3,290
White River	.....	.....	.....	.....	.....	.....	.....	.....	88	5,446
St. Francis River	70	$35	1,923	$482	70	$350	.....	.....	850	10,719
Ouachita River	.....	.....	.....	.....	.....	.....	.....	.....	40	948
Cache River	.....	.....	.....	.....	.....	.....	.....	.....	3	626
Mississippi River	.....	.....	.....	.....	.....	.....	130	$33	1,023	5,967
Horseshoe and Porter lakes	.....	.....	.....	.....	.....	.....	.....	.....	125	1,790
Big Lake	20	30	144	36	12	60	.....	.....	550	3,841
Miscellaneous waters	.....	.....	.....	.....	.....	.....	.....	.....	870	6,478
Total	90	65	2,067	518	82	410	130	33	3,601	39,105

Table showing the yield of the fisheries of Arkansas in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Arkansas River			124,500	$2,690			32,550	$1,228
White River	1,950	$147	100,900	3,571			120,300	6,599
St. Francis River			19,000	285			1,400	49
Cache River	75	6	2,700	108			600	54
Mississippi River	1,700	102	102,400	1,827	14,870	$380	2,800	113
Horseshoe and Porter lakes	600	42	25,000	500			3,000	120
Big Lake	23,000	1,150	84,000	1,260	800	12	4,200	210
Miscellaneous waters	10,700	549	518,900	10,173	3,600	89	17,100	683
Total	38,025	1,996	977,400	20,414	19,270	481	181,950	9,056
Trammel nets:								
Arkansas River			1,700	51			400	24
White River	2,400	188	30,000	1,185			8,700	634
St. Francis River	18,800	940	57,400	768			9,200	343
Ouachita River	2,400	240	4,800	192			1,300	104
Cache River	75	6	2,800	112			600	54
Mississippi River	100	6	600	12			300	12
Big Lake	18,000	900	42,000	630	200	3	3,200	160
Miscellaneous waters	1,218	65	8,500	140	100	2	650	30
Total	42,993	2,345	147,800	3,090	300	5	24,350	1,361
Pound nets:								
Arkansas River			18,000	360			4,000	160
White River	100	8	600	24			100	8
St. Francis River			225,000	3,375			6,000	210
Big Lake	8,000	400	42,000	630	400	6	9,000	450
Total	8,100	408	285,600	4,389	400	6	19,100	828
Fyke nets:								
Arkansas River			72,550	2,230			21,900	1,085
White River	3,850	398	196,000	7,462			108,900	6,809
St. Francis River	16,700	838	314,600	4,992	100	2	62,000	2,219
Ouachita River	130	13	1,800	72			3,400	264
Cache River	375	31	6,000	240			4,700	439
Mississippi River	460	28	100,840	2,342	4,098	102	3,405	132
Horseshoe and Porter lakes	335	24	7,000	140			2,100	84
Big Lake	21,000	1,050	90,000	1,350	1,000	15	8,000	400
Miscellaneous waters	8,657	490	28,600	454	260	4	4,409	193
Total	51,507	2,872	817,390	19,282	5,458	123	218,814	11,625
Set lines:								
Arkansas River			22,750	823			9,500	491
White River	3,475	254	86,550	3,073			183,550	10,359
St. Francis River			600	12			44,100	1,549
Ouachita River	690	69	5,600	244			17,800	1,254
Cache River	275	22	5,300	212			4,050	335
Mississippi River			25,100	640			80,600	3,366
Big Lake							34,000	1,035
Miscellaneous waters							7,400	111
Total	4,440	345	145,900	5,004			381,000	18,500
Miscellaneous lines:								
St. Francis River	11,000	550					2,200	110
Mississippi River							6,800	310
Big Lake	23,000	1,150					3,000	150
Miscellaneous waters	6,000	300						
Total	40,000	2,000					12,000	570
Spears:								
Big Lake			10,000	150				
Drag nets:								
Ouachita River	280	28	4,800	192			1,300	104
Total by waters:								
Arkansas River			239,500	6,154			68,350	2,988
White River	11,775	995	414,050	15,315			421,550	24,409
St. Francis River	46,500	2,328	616,600	9,432	100	2	124,900	4,480
Ouachita River	3,500	350	17,000	700			23,800	1,726
Cache River	800	65	16,800	672			9,950	882
Mississippi River	2,260	136	228,940	4,821	18,968	482	93,905	3,933
Horseshoe and Porter lakes	935	66	32,000	640			5,100	204
Big Lake	93,000	4,650	268,000	4,020	2,400	36	61,400	2,405
Miscellaneous waters	26,575	1,404	556,000	10,767	3,960	95	29,559	1,017
Grand total	185,345	9,994	2,388,890	52,521	25,428	615	838,514	42,044

Table showing the yield of the fisheries in Arkansas in 1899—Continued.

Apparatus and waters.	Crappie.		Drum, freshwater.		Eels.		Paddle-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Arkansas River			35,100	$730			34,500	$1,085
White River	9,900	$676	8,300	313				
St. Francis River	1,000	50	3,000	45				
Cache River	150	12	650	26				
Mississippi River	880	45	5,600	79			14,900	374
Horseshoe and Porter lakes	2,000	140	8,000	160			40,000	1,200
Big Lake	33,000	1,650	1,000	15			1,200	24
Miscellaneous waters	16,000	828	43,370	744			446,440	8,883
Total	62,930	3,401	105,020	2,112			537,040	11,566
Trammel nets:								
Arkansas River			500	15				
White River	3,400	270	8,000	320				
St. Francis River	17,200	860	2,800	43				
Ouachita River	80	8	1,200	48				
Cache River	375	28	650	26				
Mississippi River	150	6	700	7			200	5
Big Lake	25,000	1,250	100	2				
Miscellaneous waters	2,428	130	600	12			180	4
Total	48,633	2,552	14,550	473			380	9
Pound nets:								
Arkansas Rivér			3,000	60			4,000	120
White River	200	16	150	6				
St. Francis River	500	25	4,000	60				
Big Lake	16,000	800	300	5	200	$4	400	4
Total	16,700	841	7,450	131	200	4	4,400	124
Fyke nets:								
Arkansas River			42,450	1,316			4,000	120
White River	4,300	341	32,400	1,273				
St. Francis River	20,980	1,047	14,260	203	200	6	120	3
Ouachita River	800	80	1,300	47				
Cache River	850	71	1,100	44				
Mississippi River	625	31	17,215	281			4,065	109
Horseshoe and Porter lakes	1,800	126	4,000	80			300	9
Big Lake	40,000	2,000	800	12			600	12
Miscellaneous waters	12,286	700	2,080	39			500	15
Total	81,641	4,396	115,605	3,295	200	6	9,585	268
Set lines:								
Arkansas River			19,550	659				
White River	8,650	613	23,900	875				
St. Francis River			3,000	41	1,310	43		
Ouachita River	800	80	2,000	9				
Cache River	750	62	900	36				
Mississippi River			11,130	177	1,192	37		
Big Lake	4,800	240			800	16		
Total	15,000	995	60,480	1,797	3,302	96		
Miscellaneous lines:								
St. Francis River	1,700	85						
Big Lake	4,800	240						
Total	6,500	325						
Drag nets:								
Ouachita River	800	80	1,000	40				
Total by waters:								
Arkansas River			100,600	2,780			42,500	1,325
White River	26,450	1,916	72,750	2,787				
St. Francis River	41,380	2,067	27,060	392	1,510	49	120	3
Ouachita River	2,480	248	5,500	144				
Cache River	2,125	173	3,300	132				
Mississippi River	1,655	82	34,645	544	1,192	37	19,165	488
Horseshoe and Porter lakes	3,800	266	12,000	240			40,300	1,209
Big Lake	123,600	6,180	2,200	34	1,000	20	2,200	40
Miscellaneous waters	30,714	1,658	46,050	795			447,120	8,902
Grand total	232,204	12,590	304,105	7,848	3,702	106	551,405	11,967

Table showing the yield of the fisheries of Arkansas in 1899—Continued.

Apparatus and waters.	Pike and pickerel.		Pike perch (wall-eyed).		Rock bass.		Sturgeon, shovel-nose.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
White River	50	$7	650	$88			500	$40
St. Francis River					200	$10		
Mississippi River			357	23	990	44	900	21
Horseshoe and Porter lakes					720	50		
Big Lake	2,600	78	400	20	2,000	100		
Miscellaneous waters	580	33	220	12	425	26		
Total	3,230	118	1,627	143	4,335	230	1,400	61
Trammel nets:								
White River							2,000	80
St. Francis River	260	8	55	3	2,030	48		
Mississippi River					100	4		
Big Lake	1,600	48	150	8	400	28		
Miscellaneous waters	115	8	25	1	170	11		
Total	1,975	64	230	12	2,700	91	2,000	80
Pound nets:								
Big Lake	1,600	48	200	10	300	18		
Fyke nets:								
White River							6,000	240
St. Francis River	900	37	225	12	3,695	162	210	2
Mississippi River			831	50	2,210	93	2,270	35
Horseshoe and Porter lakes					290	15		
Big Lake	700	21	200	10	600	30		
Miscellaneous waters	214	5	155	8	396	26		
Total	1,814	63	1,411	80	7,191	326	8,480	277
Set lines:								
White River			750	73				
St. Francis River							265	3
Ouachita River			220	25				
Mississippi River							3,160	32
Total			970	98			3,425	35
Drag nets:								
Ouachita River			30	4				
Total by waters:								
White River	50	7	1,400	161			8,500	360
St. Francis River	1,160	45	280	15	5,925	220	475	5
Ouachita River			250	29				
Mississippi River			1,188	73	3,300	141	6,330	88
Horseshoe and Porter lakes					1,010	65		
Big Lake	6,500	195	950	48	3,300	176		
Miscellaneous waters	909	46	400	21	991	63		
Grand total	8,619	293	4,468	347	14,526	665	15,305	453

Apparatus and waters.	Suckers.		Sun-fish.		White bass.		Turtles.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
White River	200	$8	2,250	$174	1,250	$93		
St. Francis River	1,600	24	2,500	88				
Cache River			300	24	50	4		
Mississippi River	3,750	33	980	35			1,560	$34
Horseshoe and Porter lakes	900	18						
Big Lake	20,290	305	15,000	225			2,200	66
Miscellaneous waters	11,050	194	5,700	96			600	18
Total	37,790	582	26,730	642	1,300	97	4,360	118
Trammel nets:								
White River			3,400	271	1,225	96		
St. Francis River			8,000	202				
Cache River			250	21	50	4		
Mississippi River							250	5
Big Lake			9,000	135				
Miscellaneous waters	400	6	450	18			150	3
Total	400	6	21,100	647	1,275	100	400	8

Table showing the yield of the fisheries of Arkansas in 1899—Continued.

Apparatus and waters.	Suckers.		Sun-fish.		White bass.		Turtles.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
White River			100	$8				
Big Lake	6,200	$93	8,500	128				
Total	6,200	93	8,600	136				
Fyke nets:								
White River	500	20	3,850	309	1,600	$125		
St. Francis River	13,830	216	19,600	551			1,500	$44
Cache River			375	31	350	29		
Mississippi River	6,495	109					2,232	56
Horseshoe and Porter lakes	1,000	20						
Big Lake	12,560	188	13,000	195			800	24
Miscellaneous waters	4,300	65	3,525	69				
Total	38,685	618	40,350	1,155	1,950	154	4,532	124
Set lines:								
White River			4,950	387	2,500	175		
Cache River			700	58	225	19		
Mississippi River							398	9
Total			5,650	445	2,725	194	398	9
Total by waters:								
White River	700	28	14,550	1,149	6,575	489		
St. Francis River	15,430	240	30,100	841			1,500	44
Cache River			1,625	134	675	56		
Mississippi River	10,245	142	980	35			4,440	104
Horseshoe and Porter lakes	1,900	38						
Big Lake	39,050	586	45,500	683			3,000	90
Miscellaneous waters	15,750	265	9,675	183			750	21
Grand total	83,075	1,299	102,430	3,025	7,250	545	9,690	259

Apparatus and waters.	Shrimp.		Frogs.		Caviar.		Otter skins.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River					175	$44		
Horseshoe and Porter lakes					875	350		
Miscellaneous waters					33,125	11,094		
Total					34,175	11,488		
Spears:								
St. Francis River			25,000	$3,275				
Big Lake			6,000	700				
Total			31,000	3,975				
Guns:								
St. Francis River			35,560	4,647			360	$900
Big Lake			13,200	1,540				
Total			48,760	6,187			360	900
Otter traps:								
St. Francis River							40	100
Big Lake							100	250
Total							140	350
Shrimp traps:								
Mississippi River	7,200	$600						
Total by waters:								
St. Francis River			60,560	7,922			400	1,000
Mississippi River	7,200	600			175	44		
Horseshoe and Porter lakes					875	350		
Big Lake			19,200	2,240			100	250
Miscellaneous waters					33,125	11,094		
Grand total	7,200	600	79,760	10,162	34,175	11,488	500	1,250

Summary, by apparatus and waters, of the fisheries of Arkansas in 1899.

Apparatus and waters.	Lbs.	Value.
Seines:		
Arkansas River	226,650	$5,733
White River	246,250	11,716
St. Francis River	28,700	551
Cache River	4,525	234
Mississippi River	151,862	3,154
Horseshoe and Porter lakes	81,095	2,580
Big Lake	189,690	5,115
Miscellaneous waters	1,107,810	33,422
Total	2,036,582	62,505
Trammel nets:		
Arkansas River	2,600	90
White River	59,125	3,044
St. Francis River	115,745	3,215
Ouachita River	9,780	592
Cache River	4,800	251
Mississippi River	2,400	57
Big Lake	99,650	3,164
Miscellaneous waters	14,986	430
Total	309,086	10,843
Pound nets:		
Arkansas River	29,000	700
White River	1,250	70
St. Francis River	235,500	3,670
Big Lake	93,100	2,596
Total	358,850	7,036
Fyke nets:		
Arkansas River	140,900	4,751
White River	357,400	16,977
St. Francis River	468,920	10,334
Ouachita River	7,430	476
Cache River	13,750	885
Mississippi River	144,746	3,368
Horseshoe and Porter lakes	16,825	498
Big Lake	189,260	5,307
Miscellaneous waters	65,382	2,068
Total	1,404,613	44,664
Drag nets:		
Ouachita River	8,210	448

Apparatus and waters.	Lbs.	Value.
Set lines:		
Arkansas River	51,800	$1,973
White River	314,325	15,809
St. Francis River	49,275	1,648
Ouachita River	27,110	1,681
Cache River	12,200	744
Mississippi River	121,580	4,261
Big Lake	39,600	1,291
Miscellaneous waters	7,400	111
Total	623,290	27,518
Miscellaneous lines:		
St. Francis River	14,900	745
Mississippi River	6,800	310
Big Lake	30,800	1,540
Miscellaneous waters	6,000	300
Total	58,500	2,895
Spears:		
St. Francis River	25,000	3,275
Big Lake	16,000	850
Total	41,000	4,125
Guns:		
St. Francis River	35,920	5,547
Big Lake	13,200	1,540
Total	49,120	7,087
Otter traps:		
St. Francis River	40	100
Big Lake	100	250
Total	140	350
Shrimp traps:		
Mississippi River	7,200	600
Total by waters:		
Arkansas River	450,950	13,247
White River	978,350	47,616
St. Francis River	974,000	29,085
Ouachita River	52,530	3,197
Cache River	35,275	2,114
Mississippi River	434,588	11,750
Horseshoe and Porter lakes	97,920	3,078
Big Lake	671,400	21,653
Miscellaneous waters	1,201,578	36,331
Grand total	4,896,591	168,071

MISSOURI.

The fisheries of Missouri are conducted chiefly in the Mississippi and Missouri rivers, although considerable fishing is carried on in the St. Francis River, Little River, Big Lake, and various other waters. The number of persons employed, including fishermen and shoresmen, was 1,531, the amount of capital invested was $645,671, and the products aggregated 7,551,442 pounds, valued at $211,301. More than half of this quantity was obtained from the Mississippi River. The forms of fishing apparatus of greatest prominence, and the quantity and value of products obtained with them, were: Seines, taking 1,655,514 pounds, $52,302; fyke nets, 1,530,103 pounds, $49,189; trammel nets, 843,686 pounds, $25,420; and set and drift lines, 888,977 pounds, $35,831.

The mussel fishery yielded 2,084,000 pounds of shells, valued at $9,217, the catch being secured with crowfoot lines and rakes. The mussels were landed principally at Hannibal, Canton, and La Grange. The shipments of shells from Hannibal amounted to 30 carloads of

50,000 pounds each, of which 28½ carloads were of the variety termed "niggerheads," and the remainder were "sand shells." The niggerheads sold for 40 cents and the sand shells for 75 cents per 100 pounds.

Some of the more important species of fish obtained were: Buffalo-fish, 1,862,226 pounds, $44,743; cat-fish, 875,050 pounds, $40,755; suckers, 495,307 pounds, $14,181; crappie, 358,913 pounds, $18,310; and black bass, 394,336 pounds, $20,362. Frogs were also taken in large quantities, the catch being 237,600 pounds, valued $29,313.

Table showing, by waters, the number of persons employed in the fisheries of Missouri in 1899.

Waters.	Fisheries in which employed.											Shoresmen.	Total exclusive of duplication.
	Seine.	Trammel net.	Fyke net.	Set line.	Drift and hand line and grapnel.	Spear.	Gun.	Otter trap.	Pound net.	Crowfoot lines and rakes.	Baskets.		
Mississippi River	161	....	207	162	36	....	....	....	....	121	2	359	814
Missouri River	111	21	145	161	.....	.....	.....	.....	.....	.....	.....	47	334
St. Francis River	3	14	20	34	42	88	58	35	....	.....	....	.....	97
Little River and Big Lake	38	42	24	60	66	106	56	46	8	.....	....	.....	100
Swamps and lakes (sunken lands)	69	39	10	59	4	80	80	....	....	.....	....	.....	186
Total	382	116	406	476	148	274	194	81	8	121	2	406	1,531

Table showing, by waters, the boats, apparatus, and capital employed in the fisheries of Missouri in 1899.

Waters.	Fishing boats.		House boats.		Seines.			Trammel nets.		
	No.	Value.	No.	Value.	No.	Length (yards).	Value.	No.	Length (yards).	Value.
Mississippi River	303	$4,917	62	$3,150	61	8,370	$3,360	90	7,408	$1,634
Missouri River	*264	4,018	.....	.....	48	4,505	1,950	11	530	330
St. Francis River	99	1,790	4	200	1	150	70	7	650	240
Little River and Big Lake	97	2,000	3	180	17	2,400	1,200	21	1,800	735
Swamps and lakes (sunken lands)	169	1,998	.....	.....	27	3,420	1,430	21	1,975	569
Total	932	14,723	69	3,530	154	18,845	8,010	150	12,363	3,508

Waters.	Fyke nets.		Pound nets.		Set lines.		Drift lines, hand lines, grapnels.		Spears.		Guns.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Mississippi River	2,636	$9,907	.....	.....	774	$688	690	$68	.....	.....	.....	.....
Missouri River	541	2,701	.....	.....	286	280	.....	.....	.....	.....	.....	.....
St. Francis River	435	2,175	.....	.....	136	68	42	47	88	$120	58	$290
Little River and Big Lake	360	1,800	10	$1,000	236	120	66	77	106	178	56	280
Swamps and lakes (sunken lands)	55	267	.....	.....	120	146	4	5	80	140	80	400
Total	4,027	16,850	10	1,000	1,552	1,302	802	197	274	438	194	970

Waters.	Otter traps.		Crowfoot lines and rakes.		Baskets.		Shore and accessory property.	Cash capital.	Total investment.
	No.	Value.	No.	Value.	No.	Value.			
Mississippi River	.....	.....	234	$555	85	$127	$261,639	$222,650	$508,695
Missouri River	.....	.....	.....	.....	.....	.....	60,780	45,800	115,859
St. Francis River	2,076	$519	.....	.....	.....	.....	705	.....	6,224
Little River and Big Lake	552	138	.....	.....	.....	.....	805	.....	8,513
Swamps and lakes (sunken lands)	.....	.....	.....	.....	.....	.....	1,425	.....	6,380
Total	2,628	657	234	555	85	127	325,354	268,450	645,671

*Includes one gasoline launch valued at $650.

Table showing, by waters and apparatus of capture, the yield of the fisheries of Missouri in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	1,492	$105	197,358	$6,019	229,605	$5,282	51,403	$2,900
Missouri River	650	65	66,870	2,370	.....	.....	47,380	2,921
St. Francis River	1,000	50	5,000	75	100	2	780	39
Little River and Big Lake.	58,000	2,900	202,000	3,030	1,820	28	10,400	520
Swamps and lakes (sunken lands)	8,710	728	60,960	1,913	19,550	291	13,411	724
Total	69,852	3,848	532,188	13,407	251,075	5,603	123,374	7,104
Trammel nets:								
Mississippi River	100	10	165,670	3,970	84,500	1,455	45,817	2,355
Missouri River	.....	.....	13,380	538	.....	.....	610	37
St. Francis River	16,000	800	28,600	432	300	5	2,920	144
Little River and Big Lake.	42,000	2,100	97,000	1,455	1,550	54	7,400	370
Swamps and lakes (sunken lands)	4,370	409	34,560	1,138	8,200	164	4,745	262
Total	62,470	3,319	339,210	7,533	94,550	1,678	61,492	3,168
Fyke nets:								
Mississippi River	2,654	201	318,054	8,512	100,700	2,050	104,606	4,861
Missouri River	560	54	121,195	4,862	.....	.....	64,410	3,727
St. Francis River	36,800	1,840	104,000	1,570	600	9	10,100	485
Little River and Big Lake.	38,200	1,910	133,000	1,995	2,050	31	12,000	600
Swamps and lakes (sunken lands)	1,100	55	17,200	424	300	9	3,390	225
Total	79,314	4,060	693,449	17,363	103,650	2,099	194,506	9,898
Pound net:								
Little River and Big Lake.	21,000	1,050	104,000	1,560	800	12	18,000	900
Set lines:								
Mississippi River	.....	.....	82,304	2,174	3,175	55	107,613	4,994
Missouri River	.....	.....	33,775	1,362	.....	.....	59,445	3,611
St. Francis River	.....	.....	.....	.....	.....	.....	76,600	2,129
Little River and Big Lake.	.....	.....	.....	.....	.....	.....	111,000	3,115
Swamps and lakes (sunken lands)	.....	.....	6,300	279	.....	.....	31,380	1,275
Total	.....	.....	122,379	3,815	3,175	55	386,038	15,124
Hand and drift lines:								
Mississippi River	.....	.....	.....	.....	.....	.....	35,040	1,746
St. Francis River	51,200	2,560	.....	.....	.....	.....	8,700	435
Little River and Big Lake.	103,500	5,175	.....	.....	.....	.....	16,600	830
Swamps and lakes (sunken lands)	7,000	350	.....	.....	.....	.....	2,100	105
Total	161,700	8,085	.....	.....	.....	.....	62,440	3,116
Spears:								
St. Francis River	.....	.....	23,000	345	.....	.....	.....	.....
Little River and Big Lake.	.....	.....	48,000	720	.....	.....	.....	.....
Total	.....	.....	71,000	1,065	.....	.....	.....	.....
Grapnel:								
St. Francis River	.....	.....	.....	.....	.....	.....	12,200	610
Little River and Big Lake.	.....	.....	.....	.....	.....	.....	14,000	700
Total	.....	.....	.....	.....	.....	.....	26,200	1,310
Baskets:								
Mississippi River	.....	.....	.....	.....	.....	.....	3,000	135
Total by waters:								
Mississippi River	4,246	316	763,386	20,675	417,980	8,842	347,479	16,991
Missouri River	1,210	119	235,220	9,132	.....	.....	171,845	10,296
St. Francis River	105,000	5,250	160,600	2,422	1,000	16	111,300	3,842
Little River and Big Lake.	262,700	13,135	584,000	8,760	6,220	125	189,400	7,035
Swamps and lakes (sunken lands)	21,180	1,542	119,020	3,754	28,050	464	55,026	2,591
Grand total	394,336	20,362	1,862,226	44,743	453,250	9,447	875,050	40,755

Table showing the yield of the fisheries of Missouri in 1899—Continued.

Apparatus and waters.	Crappie.		Drum, freshwater.		Eels.		Hickory shad.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	2,489	$152	25,350	$771				
Missouri River	3,425	237	17,900	721	115	$10		
St. Francis River	2,000	100	25	1				
Little River and Big Lake	78,000	3,900	2,100	32				
Swamps and lakes (sunken lands)	13,170	707	4,000	79				
Total	99,084	5,096	49,375	1,604	115	10		
Trammel nets:								
Mississippi River	1,000	70	17,562	489				
Missouri River	477	35	525	21				
St. Francis River	19,400	970	200	30				
Little River and Big Lake	60,300	3,015	500	8				
Swamps and lakes (sunken lands)	7,165	373	3,280	80				
Total	88,342	4,463	22,067	628				
Fyke nets:								
Mississippi River	5,602	348	56,006	1,361	340	15	450	$7
Missouri River	3,798	283	33,245	1,359				
St. Francis River	50,700	2,535	760	11	300	7		
Little River and Big Lake	56,000	2,800	825	13				
Swamps and lakes (sunken lands)	900	45	180	2				
Total	117,000	6,011	91,016	2,746	640	22	450	7
Set lines:								
Mississippi River			15,337	398	2,916	109		
Missouri River	787	55	18,370	747	740	71		
St. Francis River					500	10		
Little River and Big Lake					2,300	35		
Total	787	55	33,707	1,145	6,456	225		
Hand and drift lines:								
St. Francis River	6,900	345						
Little River and Big Lake	14,000	700						
Swamps and lakes (sunken lands)	1,800	90						
Total	22,700	1,135						
Pound net:								
Little River and Big Lake	31,000	1,550	1,200	18	600	12		
Total by waters:								
Mississippi River	9,091	570	114,255	3,019	3,256	124	450	7
Missouri River	8,487	610	70,040	2,848	855	81		
St. Francis River	79,000	3,950	985	42	800	17		
Little River and Big Lake	239,300	11,965	4,625	71	2,900	47		
Swamps and lakes (sunken lands)	23,035	1,215	7,460	161				
Grand total	358,913	18,310	197,365	6,141	7,811	269	450	7

Apparatus and waters.	Mooneye or tooth herring.		Paddle-fish.		Pike.		Pike perch (walleyed).	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Mississippi River	3,595	$120	71,100	$1,986			2,653	$179
Missouri River			49,990	1,828			310	21
St. Francis River					200	$6	80	4
Little River and Big Lake			3,900	78	5,900	177	1,017	51
Swamps and lakes (sunken lands)			18,480	685	750	67	80	4
Total	3,595	120	143,470	4,577	6,850	250	4,140	259
Trammel nets:								
Mississippi River							60	6
Missouri River			2,470	91				
St. Francis River					1,100	33	160	8
Little River and Big Lake					3,900	117	475	24
Swamps and lakes (sunken lands)			1,200	60	400	32		
Total			3,670	151	5,400	182	695	38

Table showing the yield of the fisheries of Missouri in 1899—Continued.

Apparatus and waters.	Mooneye or tooth herring.		Paddle-fish.		Pike.		Pike perch (wall-eyed).	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Fyke nets:								
Mississippi River	600	$15	35,476	$882			1,778	$118
Missouri River			5,165	189	1,900	$114	9,565	586
St. Francis River			700	14	1,050	32	375	19
Little River and Big Lake			1,200	24	1,000	30	450	23
Swamps and lakes (sunken lands)							115	6
Total	600	15	42,541	1,109	3,950	176	12,283	752
Set lines:								
Missouri River			250	8			215	13
Pound net:								
Little River and Big Lake			1,000	20	3,100	93	500	25
Total by waters:								
Mississippi River	4,195	135	106,576	2,868			4,491	303
Missouri River			57,875	2,116	1,900	114	10,090	620
St. Francis River			700	14	2,350	71	615	31
Little River and Big Lake			6,100	122	13,900	417	2,442	123
Swamps and lakes (sunken lands)			19,680	745	1,150	99	195	10
Grand total	4,195	135	190,931	5,865	19,300	701	17,833	1,087

Apparatus and waters.	Rock bass.		Sturgeon, lake.		Sturgeon, shovel-nose.		Suckers.		Sun-fish.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Mississippi River	1,074	$91	700	$30	700	$12	16,545	$511	1,078	$43
Missouri River			1,550	56	17,725	646	35,785	1,390		
St. Francis River	65	3					1,400	21	1,600	24
Little River and Big Lake	4,430	222					53,850	808	29,830	437
Swamps and lakes (sunken lands)	1,070	64					166,950	5,118	3,450	142
Total	6,639	380	2,250	86	18,425	658	274,530	7,848	35,958	646
Trammel nets:										
Mississippi River	50	3	400	12	37,700	665	12,500	282		
Missouri River							1,280	49		
St. Francis River	1,300	50							7,100	112
Little River and Big Lake	2,800	140							21,000	315
Swamps and lakes (sunken lands)							81,510	2,623		
Total	4,150	193	400	12	37,700	665	95,290	2,954	28,100	427
Fyke nets:										
Mississippi River	2,436	164	6,169	199	13,550	274	32,607	901	762	39
Missouri River					4,320	167	36,495	1,401		
St. Francis River	660	25					10,600	161	22,300	342
Little River and Big Lake	940	47					11,580	174	27,000	406
Swamps and lakes (sunken lands)	100	5					9,710	262	1,400	28
Total	4,136	241	6,169	199	17,870	441	100,992	2,899	51,462	815
Set lines:										
Mississippi River					23,860	458	6,000	90		
Missouri River			400	12	52,675	2,289	3,495	142		
Swamps and lakes (sunken lands)							2,500	60		
Total			400	12	76,535	2,747	11,995	292		
Pound nets:										
Little River and Big Lake	900	45					12,500	188	16,000	240
Total by waters:										
Mississippi River	3,560	258	7,269	241	75,810	1,409	67,652	1,784	1,840	82
Missouri River			1,950	68	74,720	3,102	77,055	2,982		
St. Francis River	2,025	78					12,000	182	31,000	478
Little River and Big Lake	9,070	454					77,930	1,170	93,830	1,398
Swamps and lakes (sunken lands)	1,170	69					260,670	8,063	4,850	170
Grand total	15,825	859	9,219	309	150,530	4,511	495,307	14,181	131,520	2,128

Table showing the yield of the fisheries of Missouri in 1899—Continued.

Apparatus and waters.	White bass.		Turtles.		Frogs.		Mussel shells.		Otter skins.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Mississippi River	160	$5	24,834	$414						
Little River and Big Lake			9,600	288						
Total	160	5	34,434	702						
Trammel nets:										
Mississippi River	150	9								
Fyke nets:										
Mississippi River	450	16	7,185	238						
Missouri River	440	22								
St. Francis River			1,300	39						
Little River and Big Lake			700	21						
Total	890	38	9,185	298						
Set lines:										
Mississippi River			200	4						
Spears:										
St. Francis River					27,800	$3,618				
Little River and Big Lake					35,604	4,421				
Swamps and lakes (sunken lands)					28,200	3,290				
Total					91,604	11,329				
Guns:										
St. Francis River					44,500	5,718				
Little River and Big Lake					55,500	6,900				
Swamps and lakes (sunken lands)					45,996	5,366				
Total					145,996	17,984				
Traps:										
St. Francis River									394	$985
Little River and Big Lake									368	920
Total									762	1,905
Crowfoot lines and rakes:										
Mississippi River							2,084,000	$9,217		
Total by waters:										
Mississippi River	760	30	32,219	656			2,084,000	9,217		
Missouri River	440	22								
St. Francis River			1,300	39	72,300	9,336			394	985
Little River and Big Lake			10,300	309	91,104	11,321			368	920
Swamps and lakes (sunken lands)					74,196	8,656				
Grand total	1,200	52	43,819	1,004	237,600	29,313	2,084,000	*$9,217	762	1,905

* Value of mussel shells includes 2 pearls valued at $135.

Summary, by apparatus and waters, of the fisheries of Missouri in 1899.

Apparatus and waters.	Lbs.	Value.
Seines:		
Mississippi River	630,136	$18,620
Missouri River	241,700	10,265
St. Francis River	12,250	325
Little River and Big Lake	460,847	12,471
Swamps and lakes (sunken lands)	310,581	10,522
Total	1,655,514	52,203
Trammel nets:		
Mississippi River	365,509	9,326
Missouri River	18,742	771
St. Francis River	77,080	2,584
Little River and Big Lake	236,925	7,598
Swamps and lakes (sunken lands)	145,430	5,141
Total	843,686	25,420
Fyke nets:		
Mississippi River	689,425	20,201
Missouri River	281,093	12,764
St. Francis River	240,245	7,089
Little River and Big Lake	284,945	8,074
Swamps and lakes (sunken lands)	34,395	1,061
Total	1,530,103	49,189
Pound net:		
Little River and Big Lake	210,600	5,713
Set lines:		
Mississippi River	241,405	8,282
Missouri River	170,152	8,310
St. Francis River	77,100	2,139
Little River and Big Lake	113,300	3,150
Swamps and lakes (sunken lands)	40,180	1,614
Total	642,137	23,495
Hand and drift lines:		
Mississippi River	35,040	1,746
St. Francis River	66,800	3,340
Hand and drift lines—cont'd.		
Little River and Big Lake	134,100	$6,705
Swamps and lakes (sunken lands)	10,900	545
Total	246,840	12,336
Spears:		
St. Francis River	50,800	3,963
Little River and Big Lake	83,604	5,141
Swamps and lakes (sunken lands)	28,200	3,290
Total	162,604	12,394
Guns:		
St. Francis River	44,500	5,718
Little River and Big Lake	55,500	6,900
Swamps and lakes (sunken lands)	45,996	5,366
Total	145,996	17,984
Traps:		
St. Francis River	394	985
Little River and Big Lake	368	920
Total	762	1,905
Grapnel:		
St. Francis River	12,200	610
Little River and Big Lake	14,000	700
Total	26,200	1,310
Baskets:		
Mississippi River	3,000	135
Crowfoot lines and rakes:		
Mississippi River	2,084,000	9,217
Total by waters:		
Mississippi River	4,048,515	67,527
Missouri River	711,687	32,110
St. Francis River	581,369	26,753
Little River and Big Lake	1,594,189	57,372
Swamps and lakes (sunken lands)	615,682	27,539
Grand total	7,551,442	211,301

Table showing the extent of the wholesale fishery trade of Missouri in 1899.

Items.	No.	Value.
St. Louis:		
Establishments	8	$242,200
Cash capital	.....	208,000
Wages paid	.....	126,766
Persons engaged	219	.....
Products sold:		
Fresh and frozen fish ..... pounds	5,384,858	376,800
Salted and pickled fish ..... do	7,554,000	655,400
Smoked fish ..... do	525,755	47,020
Canned products ..... value	.....	127,000
Lobsters ..... pounds	70,087	15,418
Oysters opened ..... gallons	132,996	186,195
Oysters in shell ..... bushels	9,942	35,800
Clams ..... do	250	1,000
Turtles ..... pounds	35,800	3,580
Terrapin	1,200	150
Frogs	12,000	2,000
Tota value of products	.....	1,450,363
Kansas City:		
Establishments	7	58,500
Cash capital	.....	45,800
Persons engaged	47	.....
Products sold:		
Fresh fish ..... pounds	1,578,716	137,073
Oysters ..... gallons	216,544	299,485
Lobsters ..... pounds	196	39
Total value of products	.....	436,597

IOWA.

In 1899 the fisheries of Iowa gave employment to 2,637 persons, of whom 2,511, including 1,476 shoresmen, are credited to the Mississippi River, and the remainder to its tributaries. The amount of capital invested in boats, fishing apparatus, and shore and accessory property was $360,169. The principal forms of apparatus employed in the capture of food-fish were seines and fyke nets. Set lines, hand lines, pound nets, and trammel nets were fished less extensively. The total yield of the fisheries of the State was 23,901,922 pounds, valued at $207,801. The most important product consisted of mussel shells used in the pearl-button industry, the catch being 20,354,000 pounds, having a value, including $3,617 worth of pearls and $1,617 worth of baroque pearls, of $97,449. The food-fishes taken in greatest quantity were German carp, 1,039,375 pounds, worth $22,518; cat-fish, 750,678 pounds, worth $37,845; and buffalo-fish, 937,076 pounds, worth $26,559. Black bass, crappie, sturgeon, pike perch (wall-eyed), sunfish, paddle-fish, fresh-water drum, and suckers were also plentiful. Carp have increased to a much greater extent than any other edible species, the catch in 1899 being five times as large as in 1894. The entire catch of mussel shells and the greater part of the food-fish were obtained from the Mississippi River.

The extent of the economic fisheries of Iowa is not in proportion to the length of the water-courses, principally because of restrictive laws imposed on the operations of commercial fishermen, an interdiction prevailing against the use of any form of fishing apparatus other than hook and line except in the Mississippi and Missouri rivers.

While many of the persons engaged in fishing in Iowa depend entirely on that industry for a living, a majority of them have other vocations, especially during the winter. Many farmers along the banks of the Mississippi derive a larger income from their fishing operations than from their farms. During the season many of the fishermen inhabit temporary quarters erected along the river banks or live in house boats that may be moved from place to place. Very few of the men engaged in the fisheries are on wages, nearly all of them being independent and controlling their apparatus.

By far the most valuable fishery prosecuted in the State is the gathering of mussel shells used in the manufacture of pearl buttons. These shells are taken exclusively in the Mississippi River. In 1894 only about $2,000 worth of shells were taken, while in 1899 the value of the catch had increased to nearly $100,000. In fact the increase in value of the fisheries of this State is due entirely to the development of this industry. Various kinds of apparatus are employed in the mussel fishery, but crowfoot lines are more commonly used than any other.

The mussel shells are all sold to factories engaged in the manufacture either of pearl-button blanks or the finished buttons. In most

cases, however, only the blanks are made, these being shipped East to be finished. The manufacture of buttons from these shells was first begun in Muscatine, and that city is now the center of this industry, 28 button factories being located there in 1899. The mussel beds in the vicinity of Muscatine have become very much thinned out by continual fishing during the past few years, and the scarcity there has necessitated bringing the shells from a greater distance every year. This fact is no doubt responsible for the erection of many factories along the Mississippi River above and below Muscatine. In 1899 there were factories in 16 different towns along the latter river in this State.

With the exception of the taking of mussel shells for use in pearl-button manufacture, no branch of the fisheries of Iowa is of very recent development. The use of the various forms of apparatus has gradually increased from year to year with the increase of population and the improvement of shipping facilities. During the last four or five years the fisheries have been fully as prosperous as at any previous time. The total yield has never been greater, and more fishermen are now given employment than ever before. On the other hand, black bass, crappie, and some other game fish appear to be decreasing in abundance, as determined by the quantity caught by the fishermen.

The seines employed range in length from 50 to 250 yards each, and in depth from 10 to 20 feet, the size of the mesh being from $1\frac{1}{4}$ to $2\frac{3}{4}$ inches. Some have parallel and others tapering brails. From two to four or more persons are required to operate each seine. Where several men are required at each fishery, they share equally, the owner of the rig receiving an additional share. The season for fishing begins as soon as the ice is out of the rivers, generally about March 15, and continues until about the middle of November, periods of low water being most favorable. In some localities, especially in the Mississippi River north of Dubuque, seines are occasionally used under the ice during the winter, the catch at such times consisting almost exclusively of buffalo and fresh-water drum.

Sometimes very large hauls are made by the seines. The best haul in Iowa during the last two years was made in January, 1898, near North McGregor, and consisted of 28,000 pounds, of which 600 pounds were pike perch (wall-eyed), 9,000 pounds buffalo-fish, and 18,400 pounds fresh-water drum. In March, 1884, a very large haul was made in Minnesota Reach, near the line of Iowa and Minnesota, consisting of 240,000 pounds, almost all of which were fresh-water drum.

The fyke nets, frequently termed "bait nets" or "hoop nets" by the fishermen, have 5 to 7 hoops, usually 6, and are without leaders or wings. They are baited principally with stale cheese.

Some of the fishermen, especially about Madison, use fyke nets constructed of soft copper wire netting instead of twine. In addition to being far more durable, they are said to yield larger returns of fish.

The set-line fishery begins usually about the first of June and continues until the end of September; some of the fishermen, however, use this form of apparatus throughout the season of open water. The lines are generally baited late in the afternoon and are raised the next morning. The bait used consists of suckers, minnows, dog-fish, crawfish, dough balls, cheese, mussels, etc. The fish used for bait are caught by means of seines made of mosquito netting. These seines are about 5 yards long and cost about one dollar each. Dog-fish make the most desirable bait. These fish are obtained by seines from the shallow puddles during June and July, and are placed in live-cars, from which a supply is drawn as needed; they average about 2 ounces in weight, and each fisherman usually collects from 1,000 to 1,800 in number, which last from one to two months.

The Mississippi River fisheries are most extensive in Allamakee, Muscatine, Louisa, Des Moines, and Lee counties, but are prosecuted to some extent all along the Iowa border of this stream. Allamakee County ranks first in the quantity and value of fish produced, the annual yield approximating 700,000 pounds. In Clayton County the fishing centers are North and South McGregor, Clayton, and Guttenburg. Seines, fyke nets, and set lines are the forms of apparatus employed in these two counties, and the catch consists largely of fresh-water drum, cat-fish, buffalo-fish, carp, and suckers, which are marketed at Dubuque and other Iowa and Illinois points and even as far west as Omaha and Kansas City. Sometimes very large hauls of drum are made by the seines used in these counties.

Dubuque and Specht Ferry are the most important fishing-points in Dubuque County, and at the former place a large quantity of fish obtained from Chicago and localities up the Mississippi River are marketed. Trap nets, known locally as "pond nets," were introduced here in 1892, the idea having been obtained from Wisconsin.

Bellevue, Green Island, and Sabula are the fishing centers of Jackson County, the seine being the most important form of apparatus used. Two dealers at Bellevue handle about $10,000 worth of fish annually.

Along the Mississippi between Sabula and Muscatine, in Clinton and Scott counties, the fisheries are of small extent, except at Clinton and Davenport; but at neither one of these places is the local product equal to the market demand.

From Muscatine to the mouth of Skunk River the Mississippi is much wider, with numerous bayous, and the current much more sluggish. As a result the fisheries of this section, including the counties of Muscatine, Louisa, and Des Moines, are the most extensive in Iowa, the combined annual product in the three counties approximating 1,500,000 pounds. The fisheries are located at various points along the river, but the greater part of the catch is marketed at Muscatine and Burlington. More carp are obtained by the fishermen living in these three counties than in all the rest of the State.

In Lee County, bordering the Mississippi River, a number of fishermen use seines, trammel nets, fyke nets, and set lines at Fort Madison and along the Keokuk Canal from Montrose to Keokuk, the annual product approximating 500,000 pounds. Buffalo-fish, carp, cat-fish, fresh-water drum, and suckers are the most abundant species.

At various places along Skunk River, from its mouth to a distance of about 50 miles, economic fisheries of more or less importance existed in 1899.

On Des Moines River below Des Moines there are no commercial fisheries except at Bonaparte and Ottumwa. For several miles below Bonaparte there is some fishing with fyke nets and set lines. The catch, amounting to about 30,000 pounds annually, consists of cat-fish, buffalo-fish, suckers, carp, and fresh-water drum.

At Ottumwa, where there are a number of commercial fishermen, many persons on Sundays and holidays engage in spearing fish, the product amounting probably to 25,000 pounds annually, consisting of quillback and buffalo-fish.

Large quantities of fish are obtained from the Des Moines and Coon rivers by anglers at the city of Des Moines, as well as various other points on those streams.

The Big Sioux River forms the boundary between the States of Iowa and South Dakota. It is deep and narrow and in its lower portion is well supplied with numerous varieties of fish. Formerly considerable fishing was done all along the Big Sioux River below Sioux Falls, but at present the commercial fisheries are confined to that portion of the river below Chatsworth, the total yield amounting to about 80,000 pounds.

Compared with the Mississippi River, that portion of the Missouri River bordering the State of Iowa is not well supplied with fish. Of the seven counties which border this stream only four—viz, Woodbury, Pottawattamie, Mills, and Fremont—support commercial fisheries.

In Woodbury County the fishermen reside at Sioux City and engage principally in the fyke-net fishery, with a limited amount of set-line fishing. The catch consists mostly of cat-fish, with smaller quantities of buffalo-fish, fresh-water drum, etc.

The fishermen of Pottawattamie County fish from the mouth of Little Sioux River to the mouth of Platte River, a distance of 70 miles, the catch being marketed at Council Bluffs, Omaha, and in the interior of Iowa. Seines are the principal apparatus employed. The season usually begins about the 1st of June and continues until the river is closed by ice. The product amounts to about 80,000 pounds annually.

About 2 miles southwest of Council Bluffs is Lake Manawa, which is approximately 2 miles in length and 1 mile in width. This lake yields a quantity of large-mouth black bass, pickerel, crappie, buffalo-fish, and shovel-nose sturgeon, not only to the sportsmen, but to poachers who operate with seines. The black bass weigh from one-half to 4

pounds, the pickerel from 1½ to 12 pounds, and the crappie about one-fourth of a pound.

In Dickinson County Lake Okoboji and Spirit Lake, covering about 12 square miles each, are well stocked with fish, the principal varieties being pike perch (wall-eyed), yellow or ringed perch, grass pike, both species of black bass, and white bass. Large quantities of these are taken during both summer and winter by the anglers. During the winter hand lines are fished through holes cut in the ice. This fishery was quite extensive previous to 1895, but it is now of little consequence, due to the strong local efforts which have been made to prohibit it on account of the alleged destruction of the fishery resources of the lakes to the detriment of their attractiveness during the summer.

Table showing, by waters, the number of persons employed in the fisheries of Iowa in 1899.

Waters.	Fisheries in which employed.								
	Hand line.	Set line.	Seine.	Fyke net.	Pound net.	Trammel net.	Crowfoot line, etc.	Shoresmen.	Total, exclusive of duplication.
Mississippi River	4	263	312	217	9	119	674	1,476	2,511
Skunk River		4		3		2			6
Des Moines River		25		16					33
Big Sioux River		18	14			15			28
Missouri River		29	14	22		7			50
Iowa River			4						4
Nishnabotna River			4			3			5
Total	4	339	348	258	9	146	674	1,476	2,637

Table showing, by waters, the boats, apparatus, and capital employed in the fisheries of Iowa in 1899.

Waters and apparatus.	No.	Length (yards).	Value.	Waters and apparatus.	No.	Length (yards).	Value.
Mississippi River:				Des Moines River:			
Boats	1,058		$15,860	Boats	36		$237
Hand lines			7	Set lines	61	6,150	60
Set lines	829	89,025	827	Fyke nets	50		200
Seines	129	19,924	7,470	Shore and accessory property			70
Fyke nets	3,854		15,693	Missouri River:			
Pound nets	40		655	Boats	52		540
Trammel nets	63	6,537	1,540	Set lines	38	3,870	65
Crowfoot lines, etc			4,759	Seines	6	695	270
Shore and accessory property			188,197	Fyke nets	96		512
Cash capital			102,250	Trammel nets	4	255	110
Skunk River:				Shore and accessory property			645
Boats	6		75	Iowa River:			
Set lines	9	870	9	Boats	2		40
Fyke nets	56		242	Seines	2	180	45
Trammel nets	2	110	34	Shore and accessory property			25
Shore and accessory property			25	Nishnabotna River:			
Big Sioux River:				Boats	4		46
Boats	30		268	Seines	2	95	50
Set lines	35	1,960	38	Trammel nets	2	90	45
Seines	6	630	295	Shore and accessory property			40
Trammel nets	11	765	185	Total investment			341,669
Shore and accessory property			240				

Table showing, by waters and apparatus of capture, the yield of the fisheries of Iowa in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Hand lines:								
Mississippi River	2,500	$140						
Set lines:								
Mississippi River			41,528	$1,144	32,335	$973	236,872	$11,436
Skunk River			340	10			2,583	155
Des Moines River			6,225	225			23,230	1,552
Big Sioux River			850	34	250	10	9,780	670
Missouri River			7,100	272	480	20	10,085	746
Total			56,043	1,685	33,065	1,003	282,550	14,559
Seines:								
Mississippi River	10,097	714	357,498	8,684	629,940	13,053	63,934	3,158
Big Sioux River			19,130	795	12,965	460	300	24
Missouri River			22,525	756	15,370	482	3,280	242
Iowa River	425	28	2,615	85	5,830	120	500	30
Nishnabotna River	400	40	2,800	85	800	28	1,000	70
Total	10,922	782	404,568	10,405	664,905	14,143	69,014	3,524
Fyke nets:								
Mississippi River	3,955	317	312,890	9,364	170,905	3,706	354,800	16,818
Skunk River			11,780	365	2,000	40	1,570	94
Des Moines River	320	30	14,880	463	1,575	49	2,800	180
Missouri River			6,080	286	1,000	40	24,730	1,839
Total	4,275	347	345,630	10,478	175,480	3,835	383,900	18,931
Pound nets:								
Mississippi River	300	17	13,040	288	12,565	185	2,436	127
Trammel nets:								
Mississippi River	5,310	347	99,335	3,010	137,560	2,770	10,893	567
Skunk River	100	8	600	18	1,750	35	165	10
Big Sioux River			8,840	342	7,645	295	860	65
Missouri River			7,820	295	6,155	234	860	62
Nishnabotna River	1,050	105	1,200	38	250	18		
Total	6,460	460	117,795	3,703	153,360	3,352	12,778	704
Total by waters:								
Mississippi River	22,162	1,535	824,291	22,490	983,305	20,687	668,935	32,106
Skunk River	100	8	12,720	393	3,750	75	4,318	259
Des Moines River	320	30	21,105	688	1,575	49	26,030	1,732
Big Sioux River			28,820	1,171	20,860	765	10,940	759
Missouri River			43,525	1,609	23,005	776	38,955	2,889
Iowa River	425	28	2,615	85	5,830	120	500	30
Nishnabotna River	1,450	145	4,000	123	1,050	46	1,000	70
Grand total	24,457	1,746	937,076	26,559	1,039,375	22,518	750,678	37,845

Apparatus and waters.	Pike and pickerel.		Pike perch (wall-eyed).		Pike perch (sauger).		Rock bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Hand lines;								
Mississippi River			375	$18				
Set lines:								
Mississippi River			7,742	467				
Missouri River	1,800	$120						
Seines:								
Mississippi River	15,050	585	11,000	588	4,385	$180	1,195	$16
Big Sioux River	300	21						
Missouri River	350	28						
Nishnabotna River	500	40						
Total	16,200	674	11,000	588	4,385	180	1,195	16
Fyke nets:								
Mississippi River	2,077	111	1,175	50	1,305	54		
Pound nets:								
Mississippi River	750	30	245	12	125	5	185	3
Trammel nets:								
Mississippi River	7,165	274	3,600	156	2,035	71	925	14
Big Sioux River	1,080	74						
Missouri River	750	52						
Nishnabotna River	500	35						
Total	9,495	435	3,600	156	2,035	71	925	14
Total by waters:								
Mississippi River	25,042	1,000	24,137	1,291	7,850	310	2,305	33
Big Sioux River	1,380	95						
Missouri River	2,900	200						
Nishnabotna River	1,000	75						
Grand total	30,322	1,370	24,137	1,291	7,850	310	2,305	33

Table showing the yield of the fisheries of Iowa in 1899—Continued.

Apparatus and waters.	Drum, freshwater.		Eels.		Hickory shad.		Paddle-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Set lines:								
Mississippi River	46,490	$1,256	7,638	$600			500	$15
Skunk River	855	24	110	10				
Des Moines River			555	55				
Big Sioux River	300	12	300	24				
Missouri River	200	8						
Total	47,845	1,300	8,603	689			500	15
Seines:								
Mississippi River	168,520	3,672			180	$6	18,190	594
Big Sioux River	500	20					10,250	295
Missouri River	1,350	42					3,900	128
Iowa River	1,430	40						
Total	171,800	3,774			180	6	32,340	1,017
Fyke nets:								
Mississippi River	68,255	1,793	2,340	158	600	12	1,950	48
Skunk River	1,250	35						
Des Moines River	800	32						
Missouri River	2,200	86						
Total	72,505	1,946	2,340	158	600	12	1,950	48
Pound nets:								
Mississippi River	3,760	88						
Trammel nets:								
Mississippi River	18,205	486						
Big Sioux River	320	12						
Missouri River	1,200	36					1,600	48
Total	19,725	534					1,600	48
Total by waters:								
Mississippi River	305,230	7,295	9,978	758	780	18	20,640	657
Skunk River	2,105	59	110	10				
Des Moines River	800	32	555	55				
Big Sioux River	1,120	44	300	24			10,250	295
Missouri River	4,950	172					5,500	176
Iowa River	1,430	40						
Grand total	315,635	7,642	10,943	847	780	18	36,390	1,128

Apparatus and waters.	Crappie.		Dog-fish.		Sturgeon, lake.		Sturgeon, shovel-nose.		Suckers.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Value.
Set lines:										
Mississippi River					11,350	$323				
Missouri River					640	32				
Total					11,990	355				
Seines:										
Mississippi River	20,500	$767	5,500	$33	11,215	339	6,310	$175	75,860	$1,402
Big Sioux River									1,600	54
Missouri River					2,860	114			100	4
Iowa River	450	18							700	16
Nishnabotna River	950	67								
Total	21,900	852	5,500	33	14,075	453	6,310	175	78,260	1,476
Fyke nets:										
Mississippi River	10,175	408			6,233	205	700	13	83,748	1,766
Skunk River									870	20
Des Moines River	375	22							6,600	198
Missouri River									450	16
Total	10,550	430			6,233	205	700	13	91,668	2,000
Pound nets:										
Missouri River	625	25			550	24			1,820	37
Trammel nets:										
Mississippi River	3,135	106	650	5	2,720	87			14,843	263
Big Sioux River									2,000	60
Missouri River					1,200	60				
Nishnabotna River	900	63								
Total	4,035	169	650	5	3,920	147			16,843	323
Total by waters:										
Mississippi River	34,435	1,306	6,150	38	32,068	978	7,010	188	176,271	3,468
Skunk River									870	20
Des Moines River	375	22							6,600	198
Big Sioux River									3,600	114
Missouri River					4,700	206			550	20
Iowa River	450	18							700	16
Nishnabotna River	1,850	130								
Grand total	37,110	1,476	6,150	38	36,768	1,184	7,010	188	188,591	3,836

Table showing the yield of the fisheries of Iowa in 1899—Continued.

Apparatus and waters.	Sun-fish.		White bass.		Yellow perch.		Turtles.		Mussel shells.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Value.
Set lines:										
Mississippi River	.....	.....	.....	.....	1,875	$32	1,500	$30	.....	.....
Seines:										
Mississippi River	28,755	$641	3,820	$162	3,660	82	13,425	297	.....	.....
Iowa River	540	15	.....	.....	.....	.....	.....	.....	.....	.....
Total	29,295	656	3,820	162	3,660	82	13,425	297	.....	.....
Fyke nets:										
Mississippi River	12,705	316	2,750	120	3,255	109	2,900	59	.....	.....
Pound nets:										
Mississippi River	1,415	39	125	5	125	5	.....	.....	.....	.....
Trammel nets:										
Mississippi River	11,860	272	2,185	90	750	10	.....	.....	.....	.....
Big Sioux River	.....	.....	400	24	300	15	.....	.....	.....	.....
Total	11,860	272	2,585	114	1,050	25	.....	.....	.....	.....
Crowfoot lines, etc.:										
Mississippi River	.....	.....	.....	.....	.....	.....	.....	.....	20,354,000	$97,449
Total by waters:										
Mississippi River	54,735	1,268	8,880	377	9,665	238	17,825	386	20,354,000	97,449
Big Sioux River	.....	.....	400	24	300	15	.....	.....	.....	.....
Iowa River	540	15	.....	.....	.....	.....	.....	.....	.....	.....
Grand total	55,275	1,283	9,280	401	9,965	253	17,825	386	20,354,000	*97,449

*Includes $3.617 worth of pearls and $1,625 worth of baroque pearls.

Summary, by apparatus and waters, of the fisheries of Iowa in 1899.

Apparatus and waters.	Lbs.	Value.
Seines:		
Mississippi River	1,449,034	$35,148
Big Sioux River	45,045	1,669
Missouri River	49,735	1,796
Iowa River	12,490	352
Nishnabotna River	6,450	330
Total	1,562,754	39,295
Fyke nets:		
Mississippi River	1,042,718	35,427
Skunk River	17,470	554
Des Moines River	27,350	974
Missouri River	34,460	2,267
Total	1,121,998	39,222
Pound nets:		
Mississippi River	38,066	890
Trammel nets:		
Mississippi River	321,171	8,528
Skunk River	2,615	71
Big Sioux River	21,445	887
Missouri River	19,585	787
Nishnabotna River	3,900	259
Total	368,716	10,532
Crowfoot lines, etc.:		
Mississippi River	20,354,000	$97,449
Hand lines:		
Mississippi River	2,875	158
Set lines:		
Mississippi River	387,830	16,276
Skunk River	3,888	199
Des Moines River	30,010	1,832
Big Sioux River	11,480	750
Missouri River	20,305	1,198
Total	453,513	20,255
Total by waters:		
Mississippi River	23,595,694	193,876
Skunk River	23,973	824
Des Moines River	57,360	2,806
Big Sioux River	77,970	3,306
Missouri River	124,085	6,048
Iowa River	12,490	352
Nishnabotna River	10,350	589
Grand total	23,901,922	207,801

Table showing the extent of the wholesale fishery trade of Iowa in 1899.

Items	Dubuque.		Bellevue.		Clinton and Davenport.		Muscatine.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Establishments	2	$2,500	2	$1,500	3	$7,000	2	$2,500
Cash capital		2,500		1,500		8,500		5,000
Persons engaged	7		5		12		8	
Products sold:								
Fresh fish....pounds	314,980	16,093	241,684	10,839	543,650	25,262	394,864	17,156
Oysters.....gallons	5,500	7,150			9,500	12,050	5,000	6,500
Turtles.....pounds							9,200	115
Value of products		23,243		10,839		37,312		23,771

Items.	Burlington and Fort Madison.		Sioux City.		Total.	
	No.	Value.	No.	Value.	No.	Value.
Establishments	3	$9,600	2	$13,600	14	$36,700
Cash capital		11,500		17,000		46,000
Persons engaged	14		17		63	
Products sold:						
Fresh fish.....pounds	1,137,747	49,735	588,998	52,540	3,221,923	171,625
Oysters.....gallons	18,500	24,050	35,860	48,761	74,360	98,511
Turtles.....pounds					9,200	115
Value of products		73,785		101,301		270,251

WISCONSIN.

The fisheries of Wisconsin in the Mississippi and its tributary, the St. Croix River, were engaged in by 567 persons, and the amount of capital invested was $37,825. The products consisted of 976,735 pounds of fish of various species, valued at $22,029, and 16,260,000 pounds of mussel shells, with a value, including $4,800 worth of pearls and 3,900 worth of baroque pearls, of $66,110. The most important food-fishes were buffalo-fish, German carp, cat-fish, and sturgeon.

The greatest change that has taken place in the fisheries of this State in the Mississippi River since the last canvass in 1894 has been the development of the mussel fishery, now the most important fishery prosecuted on the river in Wisconsin. Prairie du Chien was the center of this industry in the State in 1899, about 200 men being employed here at different times of the year in taking mussels. Many valuable pearls are found in the mussels and serve as an extra inducement for the fishermen to engage in the fishery.

Two factories at Prairie du Chien were engaged in manufacturing pearl-button blanks from mussel shells, these blanks being shipped to New York City, where they were made into buttons. The two factories employed 58 men. The buildings, together with the accessory property necessary for carrying on the business, were valued at $6,360, and the cash capital required was $12,500. Between the two firms 520 tons of mussel shells were purchased at a cost of $4,224. From these shells 73,043 gross of button blanks were manufactured, having a value of $8,895.

There has been a slight decline in the fishing proper, due to the fact

that many of the regular fishermen abandoned fishing to gather mussels. Considering the value of the catch the most important apparatus used are seines, fyke nets, and set lines. Included with fyke nets are what are known locally as "bait nets," used principally in catching cat-fish. Another variety of fyke net is termed a "shut-off net," and consists of an ordinary fyke net with wings constructed of seines, the seines being used only temporarily for this purpose.

The fishing on the St. Croix River is confined to the vicinity of Hudson. The greater part of the catch was taken by means of spears used through the ice, the principal species secured being buffalo-fish, lake sturgeon, and shovel-nose sturgeon.

Table showing, by waters, the number of persons employed in fisheries of Wisconsin in 1899.

Waters.	Fisheries in which employed.									Shoresmen.	Total, exclusive of duplication.
	Set line.	Crowfoot line.	Seine.	Trammel net.	Fyke net.	Shut-off net.	Spear.	Shoulder rake.	Fork.		
Mississippi River	97	320	89	6	46	24	30	156	50	76	551
St. Croix River	2	.....	.....	.....	.....	.....	15	.....	.....	.....	16
Total	99	320	89	6	46	24	45	156	50	76	567

Table showing, by waters, the boats, apparatus, and property employed in the fisheries of Wisconsin in 1899.

Waters and apparatus.	No.	Length (yards).	Value.	Waters and apparatus.	No.	Length (yards).	Value.
Mississippi River:				Mississippi River:			
Fishing boats	432	.....	$6,843	Shore and accessory property	.....	.....	$10,730
House boats	3	.....	160	Cash capital	.....	.....	12,500
Set lines	100	*25,410	164	St. Croix River:			
Crowfoot lines	320	.....	2,415	Fishing boats	2	.....	20
Seines	29	5,580	2,170	Set lines	5	†1,600	5
Trammel nets	5	300	85	Spears	15	.....	22
Fyke nets	182	.....	2,061	Shore and accessory property	.....	.....	45
Shut-off nets	8	.....	80				
Spears	30	.....	45				
Shoulder rakes	156	.....	360				
Forks	50	.....	120	Total investment	.....	.....	37,825

*Number of hooks used, 14,465. †Number of hooks used, 1,000.

Table showing, by waters and apparatus, the yield of the fisheries of Wisconsin in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Set lines:								
Mississippi River	.....	.....	1,000	$14	.....	.....	109,300	$3,640
St. Croix River	.....	.....	.....	.....	.....	.....	15,000	560
Total	.....	.....	1,000	14	.....	.....	124,300	4,200
Seines:								
Mississippi River	3,535	$199	78,750	1,677	109,300	$1,722	58,875	2,057
Fyke nets:								
Mississippi River	.....	.....	80,000	1,356	29,915	501	36,900	1,395
Shut-off nets:								
Mississippi River	.....	.....	6,250	100	23,125	370	1,225	44
Trammel nets:								
Mississippi River	180	10	4,810	63	7,250	93	95	3
Spears:								
Mississippi River	.....	.....	2,000	55	.....	.....	.....	.....
St. Croix River	.....	.....	11,000	275	.....	.....	.....	.....
Total	.....	.....	13,000	330	.....	.....	.....	.....
Total by waters:								
Mississippi River	3,715	209	172,810	3,265	169,590	2,686	206,395	7,139
St. Croix River	.....	.....	11,000	275	.....	.....	15,000	560
Grand total	3,715	209	183,810	3,540	169,590	2,686	221,395	7,699

Table showing the yield of the fisheries of Wisconsin in 1899—Continued.

Apparatus and waters.	Sturgeon, lake.		Sturgeon, shovel-nose.		Suckers.		Sun-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Set lines:								
Mississippi River	4,825	$113						
Seines:								
Mississippi River	3,600	158	80,780	$1,729	43,160	$646	8,000	$138
Fyke nets:								
Mississippi River	4,830	126	13,000	205	42,285	610	2,400	76
Shut-off nets:								
Mississippi River					5,475	66	185	3
Trammel nets:								
Mississippi River					1,250	15	750	12
Spears:								
Mississippi River			20,000	575				
St. Croix River	12,000	350	25,000	450				
Total	12,000	350	45,000	1,025				
Total by waters:								
Mississippi River	13,255	397	113,780	2,509	92,170	1,337	11,335	229
St. Croix River	12,000	350	25,000	450				
Grand total	25,255	747	138,780	2,959	92,170	1,337	11,335	229

Apparatus and waters.	Crappie.		Dog-fish.		Drum, fresh-water.		Eels.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Set lines:								
Mississippi River					2,125	$25	1,250	$58
Seines:								
Mississippi River	5,170	$168	2,000	$15	48,800	743	435	23
Fyke nets:								
Mississippi River	1,860	66			31,700	325	60	3
Shut-off nets:								
Mississippi River					2,500	30		
Trammel nets:								
Mississippi River	1,570	47			1,150	13		
Total	8,600	281	2,000	15	86,275	1,136	1,745	84

Apparatus and waters.	Pike and pickerel.		Pike perch (wall-eyed).		Pike perch (sauger).		Rock bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Set lines:								
Mississippi River	125	$4	375	$17	1,625	$63		
Seines:								
Mississippi River	8,950	297	4,100	181	1,725	59	545	$10
Fyke nets:								
Mississippi River	2,475	90	2,185	103	1,490	48		
Shut-off nets:								
Mississippi River	185	5						
Trammel nets:								
Mississippi River	1,800	51	120	4	120	4	60	1
Total	13,535	447	6,780	305	4,960	174	605	11

Apparatus and waters.	White bass.		Yellow perch.		Other fish.		Mussel shells.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Crowfoot lines:								
Mississippi River							13,360,000	$54,460
Seines:								
Mississippi River	1,820	$68	1,660	$28	600	$6		
Fyke nets:								
Mississippi River	1,975	65						
Trammel nets:								
Mississippi River	70	2	60	1				
Shoulder rakes:								
Mississippi River							2,830,000	11,335
Forks:								
Mississippi River							70,000	315
Total	3,865	135	1,720	29	600	6	16,260,000	*66,110

*Includes $4,800 worth of pearls and $3,900 worth of baroque pearls.

Summary, by apparatus and waters, of the fisheries of Wisconsin in 1899.

Apparatus and waters.	Lbs.	Value.	Apparatus and waters.	Lbs.	Value.
Set lines:			Spears:		
Mississippi River	120,625	$3,934	Mississippi River	22,000	$630
St. Croix River	15,000	560	St. Croix River	48,000	1,075
Total	135,625	4,494	Total	70,000	1,705
Crowfoot lines:			Shoulder rakes:		
Mississippi River	13,360,000	54,460	Mississippi River	2,830,000	11,335
Seines:			Forks:		
Mississippi River	461,805	9,924	Mississippi River	70,000	315
Fyke nets:			Total by waters:		
Mississippi River	251,075	4,969	Mississippi River	17,173,735	86,504
Shut-off nets:			St. Croix River	63,000	1,635
Mississippi River	38,945	618			
Trammel nets:			Grand total	17,236,735	88,139
Mississippi River	19,285	319			

MINNESOTA.

The fisheries of Minnesota in the Mississippi region were conducted in the Mississippi and the St. Croix rivers and in various lakes. The number of persons employed was 506, the investment was $87,796, and the products amounted to 1,322,171 pounds, valued at $40,258. The leading species of fish were buffalo-fish, cat-fish, crappie, pike, pike perch, sturgeon, shovel-nose sturgeon, and suckers. Frogs were also abundant, the catch being 92,254 pounds, valued at $9,609.

On account of restrictive legislation the fisheries of the Mississippi River and tributaries in this State show a decided falling off since the last canvass of these waters, in 1894. The decrease in the catch from the lakes tributary to the Mississippi is due to the fact that no apparatus was allowed to be used in them except hand lines and spears. The resources of these lakes at the present time offer more inducements to sportsmen than to commercial fishermen.

The most important fisheries of this section of the Mississippi River are conducted between St. Paul and Winona, this region including that portion of the river known as Lake Pepin, which is about 35 miles in length, with an average width of over 3 miles. The fishery resources of this part of the river are destined to see a decided improvement on account of the mussel fishery, which, beginning in the vicinity of Muscatine, Iowa, has gradually extended up the river into Minnesota. Brownsville, however, was the only locality in Minnesota at which mussel shells were taken in 1899, and was also the highest point up the Mississippi River at which this industry was carried on.

Taking the value of the catch as the basis, the most important apparatus used on this river are haul seines, set lines, fyke nets, and trammel nets, named in the order of their importance. Included under fyke nets are what are known locally as "bait nets," which are much smaller than the ordinary fyke nets, their average length being from 8 to 10 feet. These have neither wings nor leaders, and cost $2 to $3. In using them a bag filled with stale cheese is placed near the back of the net to attract the fish. Cat-fish is the principal species taken in them.

The most valuable species taken in this part of the Mississippi River are cat-fish, buffalo-fish, shovel-nose sturgeon, German carp, wall-eyed pike, pike and pickerel, and lake sturgeon. The value of cat-fish is over one-third that of all the other species combined. Most of these were taken on set lines. The larger portion of the German carp were caught in haul seines, trammel nets, and fyke nets.

The principal species taken in the St. Croix River are buffalo-fish, lake sturgeon, shovel-nose sturgeon, and cat-fish. The catch of buffalo is divided almost equally between pound nets and spears. Sturgeon are taken principally by means of spears through the ice, but considerable quantities are secured in pound nets and haul seines. Cat-fish are taken almost entirely on set lines.

Several varieties of fish are obtained in the lakes of Minnesota, the most important of them being pike perch (wall-eyed), crappie, pike and pickerel, and bullheads. The most valuable product of these fisheries is the frog, the value of the catch in 1899 constituting nearly one-fourth that of the entire fishery yield of the State. The species taken is the "meadow frog," which is quite small, the average weight being between 1 and 2 ounces each. Frogs are caught in various ways, but chiefly in pits dug between sloughs and the adjoining high grass. The season for their capture in this manner is usually in the fall, when they are returning to the water. These pits are about 3 feet long, 2 feet wide, and 2 feet deep. Frogs are also taken by sticks and gunny sacks. In using sticks the frogs are usually killed and then sold in a dressed condition for food. Gunny sacks in a wet condition are used in their capture by being thrown over the frogs. Frogs are kept alive for market in gunny sacks placed in running water and covered with hay or straw to keep out the frost. About one-half of the frogs shipped out of the State are of small size and are sold for bait, most of them weighing less than 1 ounce each. Professional frog-catchers are said to make from $5 to $10 per day during the best of the season. Most of the catch is shipped direct to Chicago.

The frog industry in this State was started about 1895, and has grown in importance. In 1899 over $5,000 worth were taken in the vicinity of Minneapolis alone. Litchfield was the next greatest frog-producing center in the State in that year. In 1900 this industry had shifted from the latter place to Smith Lake, where one dealer purchased over $5,000 worth during the year.

Table showing, by waters, the number of persons employed in the fisheries of Minnesota in 1899.

Waters.	Fisheries in which employed.											Shoremen.	Total, exclusive of duplication.
	Hand line.	Set line.	Seine.	Trammel net.	Fyke net.	Gill net.	Pound net.	Scoop net.	Spears.	Crowfoot line.	Other apparatus.		
Mississippi River	5	31	67	10	38	.....	2	.....	.....	5	.....	38	161
St. Croix River	9	4	16	.....	1	2	21	.....	60	.....	.....	3	77
Miscellaneous lakes	165	.....	.....	.....	.....	.....	.....	8	33	.....	90	7	268
Total	179	35	83	10	39	2	23	8	93	5	90	48	506

Table showing, by waters, the boats, apparatus, and capital employed in the fisheries of Minnesota in 1899.

Waters and apparatus.	No.	Length (yards).	Value.	Waters and apparatus.	No.	Length (yards).	Value.
Mississippi River:				St. Croix River:			
Boats	93		$1,578	Fyke nets	2		$20
Hand lines			12	Gill nets	4	165	30
Set lines	31	*14,300	70	Pound nets	12		1,500
Crowfoot lines	5		40	Spears	60		90
Seines	21	5,050	1,460	Shore and accessory property			1,152
Fyke nets	75		1,270	Miscellaneous lakes:			
Pound nets	2		130	Boats	153		1,257
Trammel nets	9	610	156	Hand lines			298
Shore and accessory property			38,600	Scoop nets	6		1
Cash capital			87,000	Spears	33		49
St. Croix River:				Shore and accessory property			2,668
Boats	17		170				
Hand lines			7	Total investment			87,796
Set lines	7	†2,475	8				
Seines	5	310	230				

*Number of hooks used, 7,680. †Number of hooks used, 1,400.

Table showing, by waters and apparatus of capture, the yield of the fisheries of Minnesota in 1899.

Apparatus and waters.	Buffalo-fish.		Carp, German.		Cat-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Hand lines:						
Mississippi River					500	$12
St. Croix River					180	5
Miscellaneous lakes					99,575	1,468
Total					100,255	1,485
Set lines:						
Mississippi River	125	$2			94,500	3,288
St. Croix River					13,850	506
Total	125	2			108,350	3,794
Seines:						
Mississippi River	57,125	1,467	36,500	$588	15,040	489
St. Croix River	11,350	269	200	4	2,000	60
Total	68,475	1,736	36,700	592	17,040	549
Fyke nets:						
Mississippi River	12,750	204	5,250	57	20,800	746
St. Croix River	50	1	100	1		
Total	12,800	205	5,350	58	20,800	746
Pound nets:						
Mississippi River	2,000	60				
St. Croix River	45,000	935	800	16	5,550	185
Total	47,000	995	800	16	5,550	185
Trammel nets:						
Mississippi River	4,000	78	16,250	230	2,400	74
Spears:						
St. Croix River	45,000	975				
Total by waters:						
Mississippi River	76,000	1,811	58,000	875	133,240	4,609
St. Croix River	101,400	2,180	1,100	21	21,580	756
Miscellaneous lakes					99,575	1,468
Grand total	177,400	3,991	59,100	896	254,395	6,833

Table showing the yield of the fisheries of Minnesota in 1899—Continued.

Apparatus and waters.	Crappie.		Dog-fish.		Drum, fresh-water.		Eels.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Hand lines:								
Mississippi River	1,525	$51			625	$10		
Miscellaneous lakes	60,965	2,464						
Total	62,490	2,515			625	10		
Set lines:								
Mississippi River					15,100	206	700	$40
St. Croix River							200	22
Total					15,100	206	900	62
Seines:								
Mississippi River	2,185	82			22,885	291		
St. Croix River					5,600	109		
Total	2,185	82			28,485	400		
Fyke nets:								
Mississippi River	1,000	32			2,875	31		
St. Croix River					200	2		
Total	1,000	32			3,075	33		
Pound nets:								
St. Croix River			100	$3	6,000	81		
Trammel nets:								
Mississippi River	60	3			3,125	36		
Total by waters:								
Mississippi River	4,770	168			44,610	574	700	40
St. Croix River			100	3	11,800	192	200	22
Miscellaneous lakes	60,965	2,464						
Grand total	65,735	2,632	100	3	56,410	766	900	62

Apparatus and waters.	Pike and pickerel.		Pike perch (wall-eyed).		Pike perch (sauger).		Rock bass.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Hand lines:								
Mississippi River	1,000	$40	6,000	$328	2,400	$114	200	$12
St. Croix River	800	34			1,000	50		
Miscellaneous lakes	65,835	1,850	71,375	3,159			9,877	228
Total	67,635	1,924	77,375	3,487	3,400	164	10,077	240
Set lines:								
Mississippi River			2,375	114	3,350	122		
Seines:								
Mississippi River	10,475	359	2,810	132	4,925	146		
St. Croix River	250	11			150	7		
Total	10,725	370	2,810	132	5,075	153		
Fyke nets:								
Mississippi River	2,500	72	2,600	126	5,925	169		
St. Croix River	300	12			100	5		
Total	2,800	84	2,600	126	6,025	174		
Gill nets:								
St. Croix River	500	25			500	25		
Trammel nets:								
Mississippi River	9,350	345	2,125	155	310	15		
Spears:								
St. Croix River	21,500	410						
Pound nets:								
Mississippi River	400	24	200	18	600	36		
St. Croix River	850	43			550	29		
Total	1,250	67	200	18	1,150	65		
Total by waters:								
Mississippi River	23,725	840	16,110	873	17,510	602	200	12
St. Croix River	2,700	125			2,300	116		
Miscellaneous lakes	87,335	2,260	71,375	3,159			9,877	228
Grand total	113,760	3,225	87,485	4,032	19,810	718	10,077	240

Table showing the yield of the fisheries of Minnesota in 1899—Continued.

Apparatus and waters.	Sturgeon, lake		Sturgeon, shovel-nose.		Suckers.		Sun-fish.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Hand lines:								
Mississippi River							685	$25
St. Croix River							50	2
Miscellaneous lakes							14,995	353
Total							15,730	380
Set lines:								
Mississippi River	1,660	$30	20,000	$300				
St. Croix River			665	20				
Total	1,660	30	20,665	320				
Seines:								
Mississippi River	34,125	737	50,750	1,022	27,885	$439	1,400	44
St. Croix River	6,450	192	7,800	140	9,075	128	100	5
Total	40,575	929	58,550	1,162	36,960	567	1,500	49
Fyke nets:								
Mississippi River	3,300	65	11,000	149	6,500	67		
St. Croix River					600	8	50	2
Total	3,300	65	11,000	149	7,100	75	50	2
Pound nets:								
Mississippi River					6,250	250	400	28
St. Croix River	12,500	378	14,500	258	18,725	264	200	10
Total	12,500	378	14,500	258	24,975	514	600	38
Trammel nets:								
Mississippi River					17,150	334	585	30
Spears:								
St. Croix River	25,000	750	41,700	750				
Total by waters:								
Mississippi River	39,085	832	81,750	1,471	57,785	1,090	3,070	127
St. Croix River	43,950	1,320	64,665	1,168	28,400	400	400	19
Miscellaneous lakes							14,995	353
Grand total	83,035	2,152	146,415	2,639	86,185	1,490	18,465	499

Apparatus and waters.	White bass.		Yellow perch.		Other fish.		Frogs.		Mussel shells.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.
Hand lines:										
Mississippi River	1,400	$66			100	$4				
St. Croix River			50	$2						
Miscellaneous lakes	250	15	3,825	40						
Total	1,650	81	3,875	42	100	4				
Set lines:										
Mississippi River	250	12								
Crowfoot lines:										
Mississippi River									40,000	$160
Seines:										
Mississippi River	1,310	55			500	22				
St. Croix River					250	4				
Total	1,310	55			750	26				
Fyke nets:										
Mississippi River	900	26								
St. Croix River			50	2						
Pound nets:										
Mississippi River					400	20				
St. Croix River	100	6	50	3	750	11				
Total	100	6	50	3	1,150	31				
Trammel nets:										
Mississippi River	60	3	400	20						
Scoop nets:										
Miscellaneous lakes							18,055	$1,324		
Other apparatus:										
Miscellaneous lakes							74,199	8,285		
Total by waters:										
Mississippi River	3,920	162	400	20	1,000	46			40,000	160
St. Croix River	100	6	150	7	1,000	15				
Miscellaneous lakes	250	15	3,825	40			92,254	9,609		
Grand total	4,270	183	4,375	67	2,000	61	92,254	9,609	40,000	160

Summary, by apparatus and waters, of the fisheries of Minnesota in 1899.

Apparatus and waters.	Lbs.	Value.
Hand lines:		
Mississippi River	14,435	$662
St. Croix River	2,080	93
Miscellaneous lakes	326,697	9,577
Total	343,212	10,332
Set lines:		
Mississippi River	138,060	4,114
St. Croix River	14,715	548
Total	152,775	4,662
Crowfoot lines:		
Mississippi River	40,000	160
Seines:		
Mississippi River	267,915	5,873
St. Croix River	43,225	929
Total	311,140	6,802
Fyke nets:		
Mississippi River	75,400	1,744
St. Croix River	1,450	33
Total	76,850	1,777
Pound nets:		
Mississippi River	10,250	$436
St. Croix River	105,675	2,222
Total	115,925	2,658
Gill nets:		
St. Croix River	1,000	50
Trammel nets:		
Mississippi River	55,815	1,323
Scoop nets:		
Miscellaneous lakes	18,055	1,324
Spears:		
St. Croix River	111,700	2,475
Miscellaneous lakes	21,500	410
Total	133,200	2,885
Other apparatus:		
Miscellaneous lakes	74,199	8,285
Total by waters:		
Mississippi River	601,875	14,312
St. Croix River	279,845	6,350
Miscellaneous lakes	440,451	19,596
Grand total	1,322,171	40,258

SOUTH DAKOTA.

In South Dakota the number of persons participating in the fisheries was 72, and the capital invested amounted to $1,781. The yield was 135,893 pounds, valued at $6,941, the greater part of which consisted of buffalo-fish and cat-fish.

The Missouri River is the principal fish-producing stream in South Dakota. It flows through the State for a distance of nearly 500 miles. The Dakota section of this river contains few varieties of fish, the most abundant being cat-fish, buffalo-fish, carp, suckers, and sturgeon. In the clearer waters of the adjacent bayous and the tributary streams other varieties are found, such as grass pike, pike perch (wall-eyed), bullheads, etc. Several varieties of cat-fish are found, but the channel cat is by far the most abundant.

At the various settlements along the banks of the Missouri there are a few persons who devote a portion or the whole of their time from April to October to fishing. The principal resorts for the fishermen are Littlebend, Pierre, Chamberlain, Yankton Agency, Niobrara, Yankton, Vermilion, and Elk Point. At each of these localities a number of set lines, bait nets, and occasionally seines and trammel nets are employed, either in the main stream or at the mouths of the tributaries, but the catch is small and all of it is marketed in the immediate vicinity. Some risk attends the setting of fixed apparatus in the Missouri, because of the liability of its being covered up or borne away by the shifting sand; and numerous snags and the shifting bottom restrict the use of seines.

The eastern tributaries of the Missouri are fairly well supplied with cat-fish, bullheads, buffalo-fish, suckers, grass pike, fresh-water drum, etc. At various points the farmers and other residents occasionally fish for their home use, but the fisheries are of no commercial importance except near the mouths of the streams. Along the Dakota River below Mitchell set lines and seines are employed at times from March to October. On the Vermilion River between Centerville and the Missouri a number of seines, trammel nets, and set lines are used by the farmer-fishermen. Big Sioux River below Canton supports seine and trammel-net fisheries.

The western branches of the Missouri comprise the remaining rivers of South Dakota, principal among which are Grand, Owl, Big Cheyenne, and White rivers. The fishery resources of these rivers are of very limited extent, except in the headwaters of the Big Cheyenne in the Black Hills, where several species of fine game fish are numerous. There are no commercial fisheries in any of these rivers.

A number of lakes exist in the eastern half of South Dakota, the largest of which are Big Stone and Traverse, which form a part of the eastern boundary of the State. The former is 35 miles long and has an abundance of game fish.

Of the great variety of fish in Big Stone Lake, the most abundant are black bass, pike perch (wall-eyed), rock bass, and yellow perch. In smaller quantities are found crappie, sun-fish, cat-fish, buffalo-fish, suckers, pickerel, etc. Formerly sturgeon were quite plentiful and of large size, the catch of one weighing 137 pounds being recorded; but at present they are scarce and of small size.

Although Lake Traverse covers about as much space on the map as Big Stone Lake, it is far less important than the latter. It is about 25 miles long and from three-fourths to 1½ miles wide. The most numerous fish are suckers, and perch. This lake is not used for fishing, except that the farmers living near the shores may occasionally fish for home use.

The principal lake entirely within South Dakota is Lake Madison, about 10 miles long by 1½ miles wide. This lake formerly had quite a variety of fish, but the species now remaining are buffalo-fish, bullheads, and yellow perch. The State interdiction against commercial fishing is strictly enforced in Lake County, and little market fishing exists. For several years Lake Madison has been drying up, and the fish are dying, the pickerel apparently having become exterminated.

Lake Herman is situated in Lake County and is about 2 miles long and a mile wide. The fish found here are buffalo-fish, bullheads, and yellow perch. The vigilance of the fish wardens has prevented commercial fishing in this lake for several years, but prior to 1895 several cheap, home-made seines were surreptitiously employed, the catch being sold to the neighboring farmers and in the town of Madison.

Situated in the southwestern portion of Minnehaha County is Wall

Lake, which covers about 1 square mile in area. The principal fish in Wall Lake are bullheads, yellow perch, buffalo-fish, pickerel, and sun-fish, all of which appear to be decreasing in abundance. They are caught by means of hand lines, principally during May and June, and also under the ice during the winter. On some special days during the summer as many as 100 men are fishing for pleasure in this lake.

In addition to those mentioned there are a number of lakes containing a variety of fish in some abundance which are resorted to by pleasure fishermen, but are not utilized for commercial purposes. Prominent among these are Lake Kampeska, Clear Lake, Bear Lake, Lake Andes, Swan Lake, Long Lake, Red Lake, Lake Poinsett, Twin Lakes, etc. These contain pickerel, buffalo-fish, bullheads, perch, etc.

In various parts of the eastern half of South Dakota are so-called dry lakes. Formerly these contained considerable water and were fairly well supplied with fish, but, depending on surface drainage, they have become dry since the agricultural development of adjacent lands. Notable instances of this are found in Kingsbury County, where flax and other crops are now grown on lands covered by extensive lakes previous to 1890.

Only a small portion of the fish obtained in South Dakota pass through the hands of regular marketmen, the principal part of the catch being sold in the towns by the fishermen and through the adjacent farming regions by peddlers. The fish handled in the markets are generally obtained from outside the State, the quantity of fish brought into the State exceeding that obtained from the rivers and lakes.

Table showing, by waters, the number of persons employed in the fisheries of South Dakota in 1899.

Waters.	Fisheries in which employed.				Total, exclusive of duplication.
	Seine.	Trammel net.	Fyke net.	Set line.	
Missouri River	.....	.....	6	21	23
Missouri and Dakota rivers	4	.....	12	16	20
Missouri and Vermilion rivers	5	3	2	7	12
Missouri and Big Sioux rivers	15	2	4	2	17
Total	24	5	24	46	72

Table showing, by waters, the boats, apparatus, and property employed in the fisheries of South Dakota in 1899.

Waters.	Boats.		Seines.			Trammel nets.			Set lines.		Fyke nets.		Shore and accessory property.	Total investment.
	No.	Val.	No.	Length (yds.).	Val.	No.	Length (yds.).	Val.	No.	Val.	No.	Val.		
Missouri River	26	$228	.....	.....	.....	.....	.....	.....	46	$33	20	$61	$95	$417
Missouri and Dakota rivers	21	187	2	.....	$85	.....	.....	.....	20	20	52	208	100	600
Missouri and Vermilion rivers	12	98	2	180	38	3	110	$34	9	18	4	12	50	250
Missouri and Big Sioux rivers	14	136	6	680	210	1	80	20	4	6	10	42	100	514
Total	73	649	10	860	333	4	190	54	79	77	86	323	345	1,781

Table showing, by waters and apparatus of capture, the yield of the fisheries of South Dakota in 1899.

Apparatus and waters.	Drum, fresh-water.		Paddle-fish.		Pike and pickerel.		Sturgeon, lake.		Sturgeon, shovel-nose.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Missouri and Dakota rivers					1,200	$96			300	$12
Missouri and Vermilion rivers					1,800	117				
Missouri and Big Sioux rivers	300	$12	1,900	$48	225	14				
Total	300	12	1,900	48	3,225	227			300	12
Trammel nets:										
Missouri and Vermilion rivers					900	54				
Missouri and Big Sioux rivers					100	6				
Total					1,000	60				
Set lines:										
Missouri River			150	4			420	$15		
Missouri and Dakota rivers					200	16			100	4
Missouri and Vermilion rivers					400	27				
Total			150	4	600	43	420	15	100	4
Total by waters:										
Missouri River			150	4			420	15		
Missouri and Dakota rivers					1,400	112			400	16
Missouri and Vermilion rivers					3,100	198				
Missouri and Big Sioux rivers	300	12	1,900	48	325	20				
Grand total	300	12	2,050	52	4,825	330	420	15	400	16

Apparatus and waters.	Buffalo-fish.		Cat-fish.		Suckers.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Missouri and Dakota rivers	3,800	$138	2,300	$145	2,900	$89	10,500	$480
Missouri and Vermilion rivers	3,200	118	1,100	68	900	29	7,000	332
Missouri and Big Sioux rivers	29,260	1,160	4,128	265	7,650	244	43,463	1,743
Total	36,260	1,416	7,528	478	11,450	362	60,963	2,555
Trammel nets:								
Missouri and Vermilion rivers	300	12	3,250	184	350	12	4,800	262
Missouri and Big Sioux rivers	1,600	48	150	10	1,850	55	3,700	119
Total	1,900	60	3,400	194	2,200	67	8,500	381
Fyke nets:								
Missouri River	910	32	4,740	321	220	7	5,870	360
Missouri and Dakota rivers	4,500	167	14,340	946	1,100	40	19,940	1,153
Missouri and Vermilion rivers	350	14	950	58	70	3	1,370	75
Missouri and Big Sioux rivers	950	32	4,760	303	300	11	6,010	346
Total	6,710	245	24,790	1,628	1,690	61	33,190	1,934
Set lines:								
Missouri River	1,670	64	17,680	1,175			19,920	1,258
Missouri and Dakota rivers	600	22	7,250	470			8,150	512
Missouri and Vermilion rivers	150	5	3,120	197			3,670	229
Missouri and Big Sioux rivers			600	42	900	30	1,500	72
Total	2,420	91	28,650	1,884	900	30	33,240	2,071
Total by waters:								
Missouri River	2,580	96	22,420	1,496	220	7	25,790	1,618
Missouri and Dakota rivers	8,900	327	23,890	1,561	4,000	129	38,590	2,145
Missouri and Vermilion rivers	4,000	149	8,420	507	1,320	44	16,840	898
Missouri and Big Sioux rivers	31,810	1,240	9,638	620	10,700	340	54,673	2,280
Grand total	47,290	1,812	64,368	4,184	16,240	520	135,893	6,941

NEBRASKA.

In 1899 there were 196 persons engaged in the fisheries of Nebraska in the Missouri and Platte rivers. The capital invested was $122,884, and the products amounted to 366,617 pounds, worth $15,937. The greater part of the catch was taken in the Missouri River. The principal species obtained were buffalo-fish, 138,162 pounds, worth $4,862; cat-fish, 84,970 pounds, worth $6 068: and suckers 88.630 pounds, worth $2,967.

The commercial fisheries of Nebraska are confined to Missouri River and the Platte below Kearney. Some fish are taken in other portions of the State, and especially in the small lakes, but the fisheries there are not of commercial importance. A State interdiction exists against the use of any form of net in any of the waters of this State except the Missouri River, but this law was not enforced previous to 1899. Seines, trammel nets, set lines, and fyke nets or "bait nets" comprise the forms of apparatus employed, the first named securing over two-thirds of the yield.

Of the commercial fisheries of Nebraska over 80 per cent exist along Missouri River, the catch from that stream in 1899 being 309,422 pounds out of a total yield in the State of 366,617 pounds. Most of the counties bordering this river have commercial fisheries, the more important being located in Douglas, Larpy, and Nemaha counties. The yield in the county first named is over one-half the total product in the State. Buffalo-fish, cat-fish, fresh-water drum, and paddle-fish are the most abundant species obtained, other species being suckers, lake sturgeon, pike perch (wall-eyed), and white bass.

In Knox County a number of seines, fyke nets, and set lines are used at the mouth of Niobrara River by residents of Niobrara. The catch, consisting of 25,000 pounds of cat-fish, buffalo-fish, suckers, etc., is marketed at Niobrara, Running Water, and the adjacent regions. The current of the Niobrara is very swift, consequently fishing is limited to periods of low water or to the "slack-waters."

In Dakota County several men use trammel nets in Crystal Lake and the Missouri River. Crystal Lake is a body of clear water, situated about 2 miles from Missouri River. It contains buffalo-fish, pike perch (wall-eyed), fresh-water drum, yellow perch, and grass pike, named in the order of abundance in which taken. The catch is marketed at Sioux City, Iowa, and in the interior of Dakota. One seine and several fyke nets were also used in the Missouri River at Dakota in 1899.

At Blair, Washington County, seines, fyke nets, and set lines are employed, the catch consisting of buffalo-fish, cat-fish, suckers, paddle-fish, and fresh-water drum, all of which are consumed locally.

In Douglas County seines, trammel nets, fyke nets, and set lines

are employed, more than two-thirds of the product being obtained by the first-named apparatus. The catch is marketed principally at Omaha, but that city depends for its fish supplies mainly on Mississippi River, the Great Lakes, and the Pacific Coast. Fish from the last-named region are frequently sold in Omaha at less than is obtained for the product from the Missouri. The Douglas County fishermen occasionally resort to Cut-off Lake, an old bed of the Missouri River, located near Omaha. In addition to the usual species found in the Missouri River the pickerel or grass pike occurs in considerable abundance in this lake.

At Bellevue, in Larpy County, a number of men use seines, fyke nets, and set lines, and at Plattsmouth and Rock Bluff, in Cass County, the same forms of apparatus are used, the catch at each locality consisting of buffalo-fish, cat-fish, quillbacks, paddle-fish, suckers, and lake sturgeon.

The fishermen of Otoe County reside at Nebraska City, the apparatus employed being seines, fyke nets, trammel nets, and set lines, and the catch consists of cat-fish, buffalo-fish, lake sturgeon, fresh-water drum, and paddle-fish. In Nemaha County the fisheries are centered at Pean, Brownsville, and Nemaha, and in Richardson County at St. Deron and Rulo. Seines and set lines are used to a small extent at these settlements, the catch being similar to that obtained farther up the river. Very few of the fishermen along this portion of the Missouri depend entirely on fishing for a living, but engage also in farming and other occupations.

Because of the unfavorable conditions of having little water in a large portion of its length during many months of the year Platte River can never have more than a limited and temporary supply of fish. During high water fish enter the stream from Missouri River in considerable abundance, and for a brief period are taken in comparatively large quantities by the farmers and others residing near the river. The species are not numerous, comprising cat-fish, buffalo-fish, paddle-fish, suckers, fresh-water drum or sheepshead, lake sturgeon, and eels. Many of the farmers living along the shores of the Platte have two or three fyke nets with which they occasionally take sufficient fish for home use. Set lines are also used. These consist of 6 to 12 hooks, baited with meat or refuse fish, attached to a single line, and the line connected with the shore, where it can be readily examined every morning. As the water recedes, many fish are left in the holes or basins, and these are often obtained in great quantities by the use of hay forks. Occasionally a surplus is obtained, a ready market for which is found in the adjacent villages.

The same varieties of fish occur in Loup River as are found in the Platte, besides a large quantity of pike perch (wall-eyed), supposed to be the result of deposits made by the U. S. Fish Commission. As this

river does not run dry, fish are obtainable therefrom at all seasons. The fisheries are not of commercial extent, and the fish are utilized by persons living along the river.

Table showing the number of persons employed in the fisheries of Nebraska in 1899.

Waters.	Fisheries in which employed.				Shoresmen.	Total, exclusive of duplication.
	Seine.	Trammel net.	Fyke net.	Set line.		
Missouri River	63	11	28	58	44	145
Platte River	22	1	13	29	10	51
Total	85	12	41	87	54	196

Table showing, by waters, the boats, apparatus, and capital employed in the fisheries of Nebraska in 1899.

Waters.	Boats.		Seines.			Trammel nets.			Fyke nets.		Set lines.		
	No.	Value.	No.	Length (yards).	Value.	No.	Length (yards).	Value.	No.	Value.	No.	Length (yards).	Value.
Missouri River	104	$1,063	30	1,940	$764	9	520	$178	86	$357	99	12,830	$165
Platte River	41	366	11	375	184	1	35	15	44	175	46	5,020	67
Total	145	1,429	41	2,315	948	10	555	193	130	532	145	17,852	232

Waters.	Shore and accessory property.	Cash capital.	Total investment.
Missouri River	$40,905	$63,000	$106,432
Platte River	8,145	7,500	16,452
Total	49,050	70,500	122,884

Table showing, by apparatus and waters, the yield of the fisheries of Nebraska in 1899.

Apparatus and waters.	Black bass.		Buffalo-fish.		Cat-fish.		Crappie.		Drum, freshwater.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Missouri River	650	$65	81,460	$2,747	20,600	$1,521	400	$28	11,530	$321
Platte River			12,200	488	6,900	500			200	8
Total	650	65	93,660	3,235	27,500	2,021	400	28	11,730	329
Trammel nets:										
Missouri River			11,650	442	1,420	103			2,500	80
Platte River			300	12	120	8			100	4
Total			11,950	454	1,540	111			2,600	84
Set lines:										
Missouri River			19,840	727	17,960	1,287				
Platte River			1,300	52	14,200	996				
Total			21,140	779	32,160	2,283				
Fyke nets:										
Missouri River			9,662	322	20,470	1,412			750	27
Platte River			1,750	72	3,300	241				
Total			11,412	394	23,770	1,653			750	27
Total by waters:										
Missouri River	650	65	122,612	4,238	60,450	4,323	400	28	14,780	428
Platte River			15,550	624	24,520	1,745			300	12
Grand total	650	65	138,162	4,862	84,970	6,068	400	28	15,080	440

Table showing the yield of the fisheries of Nebraska in 1899—Continued.

Apparatus and waters.	Eels.		Paddle-fish.		Pike and pickerel.		Pike perch (wall-eyed).		Sturgeon, lake.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Seines:										
Missouri River			8,300	$196	1,750	$132			12,150	$482
Platte River			3,800	114						
Total			12,100	310	1,750	132			12,150	482
Trammel nets:										
Missouri River			2,500	75	1,250	86	800	$48	2,600	120
Platte River			125	5						
Total			2,625	80	1,250	86	800	48	2,600	120
Set lines:										
Missouri River									1,900	92
Platte River	300	$25	1,650	54						
Total by waters:										
Missouri River			10,300	271	3,000	218	800	48	16,650	694
Platte River	300	25	5,575	173						
Grand total	300	25	16,375	444	3,000	218	800	48	16,650	694

Apparatus and waters.	Suckers.		White bass.		Yellow perch.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Missouri River	57,580	$1,956					194,420	$7,448
Platte River	6,700	245	200	$10			30,000	1,365
Total	64,280	2,201	200	10			224,420	8,813
Trammel nets:								
Missouri River	10,110	253	100	6	300	$12	33,230	1,225
Platte River	200	8					845	37
Total	10,310	261	100	6	300	12	34,075	1,262
Set lines:								
Missouri River	3,550	130					43,250	2,236
Platte River	1,150	46	1,000	50			19,600	1,223
Total	4,700	176	1,000	50			62,850	3,459
Fyke nets:								
Missouri River	7,640	265					38,522	2,026
Platte River	1,700	64					6,750	377
Total	9,340	329					45,272	2,403
Total by waters:								
Missouri River	78,880	2,604	100	6	300	12	309,422	12,935
Platte River	9,750	363	1,200	60			57,195	3,002
Grand total	88,630	2,967	1,300	66	300	12	366,617	15,937

Table showing the extent of the wholesale trade in fishery products in Nebraska in 1899.

Items.	Number.	Value.
Establishments (1 at Lincoln, 3 at Omaha)	4	$48,000
Cash capital		70,500
Persons engaged	54	
	Pounds.	Value.
Products sold:		
Fresh fish	1,805,312	$165,484
Lobsters	12,562	2,512
Oysters	3,158,650	428,402
Total products	4,976,524	596,398

KANSAS.

While the fisheries of Kansas are of considerable economic importance in furnishing a supply of fresh food to persons living adjacent to the streams, yet commercially they are of small extent. The total number of professional fishermen in the State in 1899 was only 118, and the product was 277,920 pounds, for which the fishermen received $13,546. The investment in the fisheries was $3,836.

The fyke-net fishery was the most important, yielding 138,445 pounds, or nearly 50 per cent of the total product. Set lines, seines, and trammel nets ranked next in order and complete the list of apparatus employed. The principal species obtained were cat-fish, buffalo-fish, fresh-water drum, paddle-fish, suckers, eels, and lake sturgeon, the two first named comprising a large part of the catch. Along that portion of the Missouri River bordering the State of Kansas the fisheries are located at the principal centers of population, viz, Atchison, Leavenworth, and at the mouth of Kansas River.

While the fisheries in the vicinity of Atchison are of much local importance, they do not wholly supply the markets of that city. The fishing-grounds are in the Missouri River and certain of its old beds, the most important of which is Doniphan Lake, which is 2½ miles long, three-fourths of a mile wide, and 2 to 25 feet deep. Some of the lakes are fed almost constantly by springs and small streams of clear water, in addition to the somewhat irregular inflow from the Missouri River. The fisheries are prosecuted in the spring and fall during the periods of low water.

The principal fishes in the vicinity of Atchison are cat-fish, buffalo-fish, paddle-fish, fresh-water drum, lake sturgeon, and suckers, three-fourths of which are taken by means of seines and lines. Haul seines are used on the sand bars in the river during low water, and in the lakes more or less at all times in the season. Set lines are used to some extent throughout the year, but principally during the spring. The trammel nets and hoop nets or fyke nets are used in the "slack waters," or arms of the main stream. Several lakes in this vicinity have been stocked with fish not indigenous to the region, such as pike perch (wall-eyed), pickerel, yellow perch, crappie, black bass, etc.

The fisheries of Leavenworth are of little consequence, consisting of a limited set-line, fyke-net, and seine fishery, in which from 12,000 to 20,000 pounds of buffalo-fish, cat-fish, lake sturgeon, fresh-water drum, suckers, and paddle-fish are annually obtained. The fish markets of Leavenworth depend on supplies from Illinois River, the Great Lakes, and the Pacific coast, in addition to the small local production.

The most extensive fisheries of Kansas River are near the entrance of that stream into the Missouri. Some use is made of seines and trammel nets, but the fyke-net or hoop-net fishery is by far the most important, yielding 80 per cent of the total product. Suckers are the most numerous species, with cat-fish and buffalo-fish next in order;

other species are fresh-water drum, eels, crappie, rock bass, black bass, pike perch (wall-eyed), etc. All of these are less abundant than formerly, which is partly attributable to the increased demand of a growing community. Other causes have doubtless contributed to the decrease, among which are the dam at Lawrence and sewage from the cities.

The fisheries of Lawrence are the most important on the Kansas River above Kansas City, yet they are not so extensive as a few years ago. During the high waters of the spring cat-fish, suckers, and buffalo-fish from the Missouri pass up Kansas River as far as the Lawrence dam, where they are taken in large quantities. The fishermen operate between the dam and Eudora. Set lines and fyke nets are used, the catch consisting of cat-fish, buffalo-fish, suckers, fresh-water drum, and eels. The cat-fish average in weight about 15 pounds, with a maximum of 100 pounds, and buffalo-fish from 10 to 30 pounds.

Topeka is the center for the fisheries of the Kansas River above the Lawrence dam, the annual yield approximating 15,000 pounds. The catch is obtained by a half dozen men fishing between Lawrence and Silver Lake, an old bed of the river about 10 miles west of Topeka.

Table showing, by waters, the number of persons employed in the fisheries of Kansas in 1899.

Waters.	Fisheries in which employed.				Total, exclusive of duplication.
	Seine.	Trammel net.	Fyke net.	Set line.	
Missouri River	12	9	8	36	45
Kansas River	6	2	57	38	73
Total	18	11	65	74	118

Table showing, by waters, the boats, apparatus, and property employed in the fisheries of Kansas in 1899.

Waters.	Boats.		Seines.			Trammel nets.			Fyke nets.		Set lines.		Shore and accessory property.	Total investment.
	No.	Value.	No.	Length (yards).	Value.	No.	Length (yards).	Value.	No.	Value.	No.	Value.		
Missouri River	44	$466	5	560	$218	5	440	$140	35	$176	56	$124	$220	$1,344
Kansas River	74	821	3	225	60	1	50	20	247	1,213	45	81	297	2,492
Total	118	1,287	8	785	278	6	490	160	282	1,389	101	205	517	3,836

Table showing, by waters and apparatus of capture, the yield of the fisheries of Kansas in 1899.

Apparatus and waters.	Crappie.		Eels.		Sturgeon, lake.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Fyke nets:						
Kansas River	100	$8	450	$36	600	$18
Set lines:						
Missouri River					1,200	60
Kansas River			620	58		
Total by waters:						
Missouri River					1,200	60
Kansas River	100	8	1,070	94	600	18
Grand total	100	8	1,070	94	1,800	78

Table showing the yield of the fisheries of Kansas in 1899—Continued.

Apparatus and waters.	Black bass.		Buffalo-fish.		Cat-fish.		Drum, fresh-water.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Missouri River			9,520	$390	6,385	$462	880	$36
Kansas River			900	45	1,835	110	750	30
Total			10,420	435	8,220	572	1,630	66
Fyke nets:								
Missouri River			4,700	193	3,945	269	540	18
Kansas River	60	$6	19,545	825	31,680	1,913	2,500	101
Total	60	6	24,245	1,018	35,625	2,182	3,040	119
Set lines:								
Missouri River	600	48	6,280	291	23,130	1,569	650	21
Kansas River			4,600	213	23,600	1,476	1,550	69
Total	600	48	10,880	504	46,730	3,045	2,200	90
Trammel nets:								
Missouri River			6,210	256	4,220	328	700	28
Kansas River			240	12	165	10	375	15
Total			6,450	268	4,385	338	1,075	43
Total by waters:								
Missouri River	600	48	26,710	1,130	37,680	2,628	2,770	103
Kansas River	60	6	25,285	1,095	57,280	3,509	5,175	215
Grand total	660	54	51,995	2,225	94,960	6,137	7,945	318

Apparatus and waters.	Paddle-fish.		Pike and pickerel.		Suckers.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Missouri River	1,700	$68	200	$16	14,360	$502	33,045	$1,474
Kansas River	500	15			2,370	95	6,355	295
Total	2,200	83	200	16	16,730	597	39,400	1,769
Fyke nets:								
Missouri River					2,200	83	11,385	563
Kansas River					72,125	2,898	127,060	5,805
Total					74,325	2,981	138,445	6,368
Set lines:								
Missouri River					7,725	316	39,585	2,305
Kansas River					2,350	101	32,720	1,917
Total					10,075	417	72,305	4,222
Trammel nets:								
Missouri River	1,650	62	125	10	9,985	342	22,890	1,026
Kansas River	4,000	120			100	4	4,880	161
Total	5,650	182	125	10	10,085	346	27,770	1,187
Total by waters:								
Missouri River	3,350	130	325	26	34,270	1,243	106,905	5,368
Kansas River	4,500	135			76,945	3,098	171,015	8,178
Grand total	7,850	265	325	26	111,215	4,341	277,920	13,546

NOTES

ON THE

BOATS, APPARATUS, AND FISHING METHODS EMPLOYED BY THE NATIVES OF THE SOUTH SEA ISLANDS, AND RESULTS OF FISHING TRIALS BY THE ALBATROSS,

BY

A. B. ALEXANDER,

Fishery Expert, U. S. Fish Commission Steamer Albatross.

NOTES ON THE BOATS, APPARATUS, AND FISHING METHODS EMPLOYED BY THE NATIVES OF THE SOUTH SEA ISLANDS AND RESULTS OF FISHING TRIALS BY THE ALBATROSS.

By A. B. Alexander,
Fishery Expert, U. S. Fish Commission Steamer Albatross.

On August 23, 1899, the U. S. Fish Commission steamer *Albatross* sailed from San Francisco for the South Sea Islands, touching at the island of Nukuhiva, Marquesas group, September 17, and from that time until February 21, 1900, ten groups of islands were visited and landings were made at 59 places. While fishing is carried on at all the inhabited islands in each group, yet in no one place is it prosecuted to any great extent, but is a local affair and hardly considered beyond the needs of home consumption. Tahiti seems to be the only island where commercial fishing is carried on, and here only to a limited extent, at Papeete. The natives here are given more to tilling the soil, leaving the fisheries to a small colony of Gilbert Islanders, who were brought to Tahiti a number of years ago for that purpose. These fishermen follow their calling the year round, but the average weekly catch is small, not exceeding the amount that would be required to supply a town of 1,500 people.

In the present paper are given notes on the fisheries, fishing boats, and fishing appliances of the various islands, in the order in which they were visited. The results of the fishing done by the *Albatross* are also recorded, together with some reference to the collecting of natural-history specimens.

For the photographs and sketches with which the report is illustrated I am indebted to Mr. Alexander Agassiz, Mr. C. H. Townsend, Mr. A. G. Mayer, Mr. W. McM. Woodworth, Mr. H. C. Fassett, and Mr. V. Arnkil.

THE MARQUESAS ISLANDS.

The first landing was at Tai-o-hae, Nukuhiva Island, Marquesas group. This is a small village comprising some three or four hundred natives and a sprinkling of white people. The white colony is composed chiefly of French government officials and business men. The natives live largely on the products of the soil, such as cocoanuts,

bananas, oranges, breadfruit, etc. Their wants are so easily supplied that the taking of fish for food is of minor importance. It is said that the other settlements on the island pay as little attention to fishing as do the natives of Tai-o-hae.

The fishing is conducted with seine, hook and line, and spear. The seines are machine-made, 40 to 60 fathoms long, and 2½ to 3 fathoms deep; size of mesh, 2½ and 3½ inches stretch measure. In the early days the seines were knit by the natives, but soon after trading vessels began touching at the island and stores were established the knitting of nets was practically given up. Hand-line fishing is confined to rocky areas at the mouth of the harbor. The water is comparatively deep close to the shore, and twenty-odd fathoms in the middle of the channel. By anchoring their canoes near the projecting rocks or drifting with the tide or wind along the shores fairly good catches are made. The fisherman either starts out very early in the morning or about an hour before sundown. At other times it is almost useless to try for bottom fish. Usually much patience is necessary in fishing with hand lines, for these fish do not readily take the hook; but as the native has abundance of time, it matters but little if an hour or two is consumed in securing a single fish.

The fish taken with spear are quite large and are caught outside the harbor by the aid of a torch. The spears have four iron prongs fastened closely together at the end of a pole, with the barbs on the inside of the circle facing each other. The pole is 8 to 9 feet long, with a line attached to the end to prevent it from being lost and also to draw it back when a fish has been missed. At certain seasons of the year large numbers of fish are sometimes taken in a comparatively short time. The fishing excursions are generally made on the dark of the moon, fish being most numerous at that time.

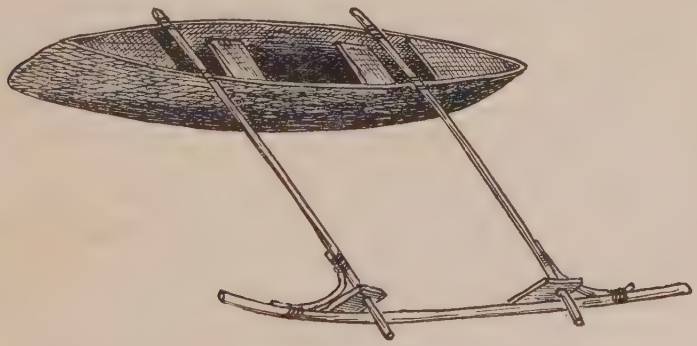
At the head of the harbor are two beaches, each making off shallow for about 200 feet, then suddenly falling off into comparatively deep water. The bottom at this depth, so far as could be observed, is composed of fine sand with a few rocks. Both beaches are about a half mile long, suddenly terminating in volcanic rock and small beach bowlders. In front of the village the beach is very rocky.

During the stay at Nukuhiva collections were made chiefly with drag seine. Six hauls were made on the beaches, taking seven species of fish, including a number of bonito, pompano, and a small sardine, with others not identified; specimens of all were saved.

A cod trawl was set near the entrance of the harbor, the inner end in 6 fathoms of water, the outer end in 23 fathoms; hard bottom in shore and quite soft in the middle of the channel; the bait used was salt herring and smelts. The trawl remained down about two hours with negative results. The bait had not been touched. Unsuccessful trials were made with hand lines. We were informed by a native that

anywhere off the mouth of the harbor bottom fish were plentiful, but he probably meant surface fish. Neither the trials with hand lines nor with trawl could be considered a fair test of the ground, as tropical fish do not bite readily on salt bait, and satisfactory results may rarely be expected from using it.

The boats in use on this part of the island are the canoe and whaleboat. The style of canoe has undergone little change for many years, except that the large canoe has been discarded for the whaleboat, it having been introduced among these people by the early whalers. Whaleboats are used mostly for making passages to different parts of the island and to other islands, and do the work formerly performed by large canoes; they range in length from 26 to 35 feet and are modeled from the regular New Bedford boat. These boats cost from $200 to $250, according to size and finish. The dimensions of one were as follows: Length, 26 feet; width, 5½ feet; depth, 2 feet; number of thwarts, 6. The mast steps through the second thwart from the bow;



Canoe, Nukuhiva Island.

standing platform aft 5½ feet long and 2 feet wide on the forward end, raised 9 inches above the keel. Boat decked over fore and aft, 2½ feet forward and 4 feet aft; ceiled to the risings. Excellent workmanship is displayed in the build and all the fittings. The sails are cotton and are cut according to whaleboat fashion; sprit, boom, and high peak.

Whales and black-fish make their appearance each season, and these boats are then most useful. Many of the inhabitants have been engaged in the whale fishery, sailing in ships from New Bedford and San Francisco, and they capture whales and black-fish by the white man's method. Black-fish entering the harbor are often captured by being driven ashore in the same manner as on the coast of New England.

Nearly every native owns a canoe, varying in length from 12 to 20 feet. A small one measured 12 feet long, 3½ feet across the gunwales, and 1 foot wide at bottom; depth, 2 feet. This canoe, like others observed, had three thwarts with a hole through the forward one for stepping the mast. A majority of the canoes were dugouts, but a

number were put together in clinker-built style, except the bottom, that being composed of a solid piece, probably the bottom of an old canoe. This style is no doubt a departure from the original build. It is important that the bottoms of canoes should be of hard wood, in order to withstand the hard usage received in landing through the surf on the beach. Both ends of the canoe are alike, there being nothing to indicate bow or stern. The only distinguishing mark is the outrigger, or that portion of it that sets in the water, one end being pointed, so as to offer little resistance. The outrigger float is 4 to 5 inches wide and 3 inches deep; sometimes a round pole is used. The bow of the canoe is indicated by the sharp end of the outrigger, which is on the right of the man paddling, or starboard side. The outrigger is to give the canoe stability, as without it she would not set upright in the water, the width not corresponding to the depth.

From the gunwale to the outrigger float of these canoes is on an average 7 feet. The outrigger frame consists of 5 pieces of wood, namely, 2 poles or crosspieces seized across the gunwales 4½ feet apart, one forward and the other aft of center; 2 stanchions connecting crosspieces to the outrigger float, and a brace which is seized to crosspieces just outside the gunwale. That part of the crosspieces between the gunwales answers the purpose of thwarts, the upper side being hewn to a flat surface. The outboard ends are seized to the perpendicular pieces, or stanchions, the length of which is, as a rule, the distance from the gunwale to the water line. These pieces are seized to the top side of the float, the seizings extending all the way round the float, but done so neatly as to offer little resistance to the water. The crosspieces, float, and stanchions are braced with withes to prevent them from being twisted and thrown out of position by coming in contact with rocks, sunken logs, and branches of trees. The material used in seizing the outrigger frame together is cocoanut fiber twisted into a small line. Both paddles and oars are used, one equally as well as the other.

We saw no canoes under sail. The large war canoes which were at one time common have gone out of existence. It is quite evident that the small canoes are built with less care than formerly.

THE PAUMOTU ISLANDS.

On the morning of September 21 the *Albatross* anchored off the village at Rahiroa Island, Paumotu group, where it remained until the morning of the 24th.

So far as the investigations extended no suitable beaches for hauling a seine were found. In a few places small collecting seines could be used, but great care is necessary in evading small pieces of coral, sticking up an inch or two through the sand, barely visible to the eye. One of these pieces is sufficient to render the net useless. Besides the live coral many pieces of fossil coral are scattered over the bottom.

The best place for collecting with a seine was in a small bay near the mouth of the entrance to the lagoon, about a half mile from the western end of Mohican Island. Here in most parts the water is shallow and at low tide the flats are bare. A channel some 300 feet wide follows from the head of the bay along the west side where fish school at full tide. The bottom of the channel, however, is strewn with live and dead coral and tree branches.

The shore collection consisted of holothurians, small shells of various species, and a number of small-sized tridacna. A few fishes were found under rocks. A trammel net was set near the ship at the surface; the depth of water, 3 fathoms. On account of the jagged bottom it was not deemed advisable to set the net near it. At the end of 3½ hours the net was hauled, taking from it 38 fish, all of one species. For fear that sharks would get into the net and destroy it, no trials were made during the night.

A crab net was set from the ship and a large fish taken, weighing 38 pounds. Its color was green, and in general appearance it resembled the fathead of California. It being too large for a specimen, it was used for bait.

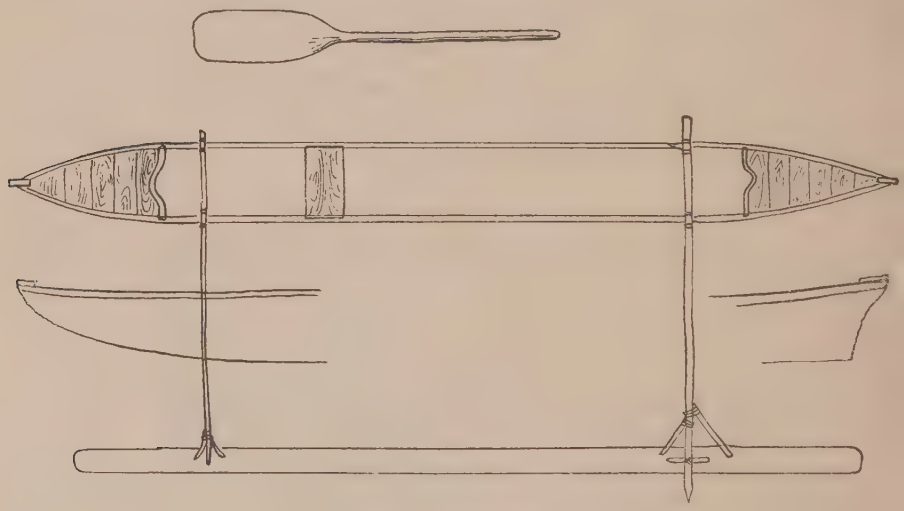
Hand-line fishing was more successful than any other method in procuring a variety of fish, about 80 in number being caught from the ship, representing nine species. Hand lines were also used from the boats, but nothing was caught. It was quite evident that offal from the ship attracted fish. Natives a short distance away were engaged in fishing from canoes, but so far as could be observed they caught nothing. It was supposed that they were on one of the local fishing-grounds, as this particular spot was frequented more than elsewhere.

Two lobster pots were set, one from the ship and the other a short distance away, in water not over 5 fathoms deep. The pot set from the ship took a fish 3¾ feet long belonging to the eel family. The bait in the other trap was partially eaten, probably by small fishes. Shells of crayfish were noticed on the beach in several places. This species is taken chiefly with spear at night by the aid of a torch.

The trials with drag seines were almost a complete failure, owing to the roughness of the bottom. In several hauls made with a 25 and 75 foot net six species were secured, among which were twelve mullet, a trigger-fish, a pompano, and a number of small coral-fish. The hauls were made in the bay to the westward of Mohican Island. It was impossible to make a complete haul with either seine, and it was only by lifting the foot line and bag of the seine over the sharp coral patches that a partial haul was made.

Near the place where the trials with drag seines were made were three inclosures made of fossil coral piled to the height of 3 feet, which at a distance resembled stone walls. The inclosures were rectangular in shape, 50 feet long by 25 feet wide, with an opening at the

offshore end 6 feet wide. From the center of the opening or mouth was a lead 75 feet long, built of the same kind of material. Inside the traps the bowlders and coral had been cleared away, leaving the bottom smooth. These inclosures, or traps, as they are commonly called, are entered by various kinds of fish at every tide. There is nothing to prevent them from making their escape at all times. At low water and at half tide the natives repair to them armed with dip nets and spears. The fishermen approach the traps cautiously and take their positions. At a given signal each man arises from his stooping position and takes a quick survey of the inside, ready to strike with his spear the first fish noticed. A commotion and general stampede quickly follows the appearance of a human form above the wall. Frequently a half dozen



Canoe, Rahiroa Island.

or more fish are speared before reaching the mouth of the trap. Here they are met with dip nets. Many large fish escape, but a considerable number of small ones are captured.

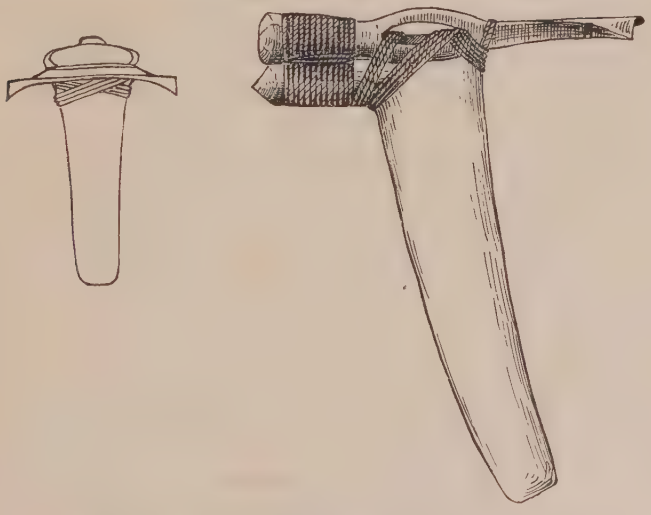
No large amount of fish is required at one time. As all fish caught must be consumed within a few hours, there is no incentive to lay in more than can be eaten at one meal. The spears used by these people are of the same pattern as those observed at the Marquesas Islands.

Mr. Agassiz and party made a trip in the steam launch across the lagoon to the opposite side of the atoll, a distance of 15 miles, and while studying the formation of coral several rock fish-traps were observed, one of which led into a ravine. On inquiry it was learned that fishing excursions are frequently made to this part of the atoll.

The hand lines used for bottom fish have a single hook and sinker attached. Trolling hooks are larger and are fastened to a long lanyard covered with heavy canvas. The object of the lanyard is to prevent

the line from being bitten off. If the line were attached directly to the hook, few fish would be caught. No ordinary line would last through one fishing trial. The hooks are home-made and the workmanship is neat, but they of course lack the finish of a machine-made hook. They are manufactured out of such iron as may be at hand, old bolts and nails being brought into use when better material is not obtainable. No wooden or bone hooks were seen, they having disappeared some years ago. The fishing lines were machine-made.

The canoes of this island show no marked difference from those of Nukuhiva except that they are all dugouts, with no devices of the white man attached, and fall short in workmanship of most of those found throughout Alaska. A number of sloop-rigged boats, 25 to 40 feet in length, were hauled up on the beach. They call for no special mention,



Large and Small Adze used in making Canoes, Paumotu Islands.

having been brought here by white traders. One boat was on the stocks about half planked. Her dimensions were: Length over all, 38 feet; width, 9½ feet; depth, 3 feet; timbers, 16 inches apart. The work displayed was fairly good. Her lines were copied from one of the boats lying on the beach. I was informed that she was being built by two natives. She had been on the stocks for a long time, as most of the material in her indicated.

MAKATEA ISLAND.

On the morning of October 6 a collecting party was landed on the northwest side of this island. Our collecting was confined to the reef, where with difficulty we succeeded in taking a few fish with a small Baird seine and a dip net. The reef here is so rough that only in a very few places could the seine be hauled, and in the favorable

spots it was found possible to drag it only a few feet at a time, and the fish usually escaped long before the net could be landed. The most successful method of capture was to place the seine across the mouth of pools in the reef, made by the action of the sea, and drive the fish into it. The seine was used as a kind of dip net, a man stationed at each end to lift it up at a moment's notice when the fish crossed the foot-line. In this way 150 small fish of five species were captured.

On the reef were hundreds of pools, many of which were connected by channels through which the fish made their escape to the sea. During the high water the sea breaks over the entire reef, and on receding leaves many small fish in the pools. At the outer edge of the reef, where the water suddenly makes off deep and the sea breaks heavily against the ragged coral, forcing its way into the numerous cuts and ravines, fish of considerable size could be seen; but it was impossible to use a seine, and a dip net was of little use. The fish were as shy as trout, and by the time the dip net touched the water not one could be seen. We could stand stationary without causing them any alarm, but the slightest movement on our part would create a stampede. Each fish seemed to have a separate hiding-place, into which it darted. Occasionally a very heavy sea would sweep over the reef with great force. At such times it seemed as if the fish concealed in the gulches must be dashed to pieces against the sharp coral, but on the subsiding of the water they were darting back and forth as if there had been no disturbance.

Shells, starfish, crabs, and holothurians were among the life gathered with dip net along the shore. That part of the reef left bare at low water is quite level, and the surf frequently sweeps over it, filling the cavities and pools with a fresh supply of water. In many of the depressions the bottom was covered with holothurians, in others small starfish and shells; crabs were found under the edge of bowlders.

Hauled up on the beach was an old canoe, of the same model as those observed at Tahiti. Length, 10 feet; width, 14 inches; depth, 11 inches; outrigger float, 9½ feet long, 3¾ inches in diameter, extending out by the bow 6 inches. The outrigger float was made of koa wood. This wood is very light and buoyant. The crosspieces connecting the float to the canoe were 5 feet long; forward crosspiece projecting out by opposite gunwale 18 inches, the after one flush with it. The canoe was poorly made, and on the whole a poor specimen.

NIAU ISLAND.

On the morning of October 7 a landing was made on this island. The atoll has no passage leading into it and canoes have to be taken across the rim into the lagoon, a distance of about a third of a mile. The natives informed us that most of the fishing was done in the lagoon,

although there was some hand-line fishing off the outside reef. Fish from the lagoon are much preferred to those from outside. A trader, the only white person on the island, told us that only one species of fish was found in the lagoon. It is said to be of fine quality and furnishes the natives with a large amount of their food.

Samples of coral and shells were obtained from the beach and 2 fish from the lagoon.

Strung along the beach were seines drying on racks, others were in sheds, and piled in the corner of one shed was a lot of webbing, seine rope, and corks. The webbing was machine-made, of 2½-inch mesh, stretch measure. The only canoes seen were engaged in fishing some little distance from our anchorage.

The beach on the lagoon side of the island is composed of fine coral sand and minute shells. The water deepens gradually and as far as we could see the beach continued smooth. Our stay being short, we had no time to investigate the surroundings. No fishing was going on in the lagoon, but the trader informed us that a haul or two with a seine seldom failed to capture all the fish required. On the opposite side of the lagoon the sea breaks over the rim in rough weather. The water in the lagoon is said to be considerably salter than the ocean.

The natives of this island are left to themselves a greater part of the time. They seemed contented and prosperous.

APATAKI ISLAND.

A short run brought us to Apataki, where we arrived in the evening, and lay off the entrance of the pass until the next morning, when a party landed and remained on shore two hours. No collection of fishes was made. In the passage leading into the lagoon were many fish close to the edge of a bank of coral; they could not be taken with hook and line, and it was impossible to use a seine. The only thing we saw in the way of fishing gear was a trolling hook, made of iron, and attached to a long snood, which was served with canvas. The line was common white cotton, machine-made.

Near the village, at the head of a small arm one-third of a mile long and about 600 feet wide at the mouth, was a trap made of coral rock. The head of the arm is cut off from the ocean by a wall of old coral which has been thrown up by the sea. When the sea is heavy it breaks over the wall and pours into the arm, and we were informed that at such times fish were brought in over the wall. Near this wall was the fish-trap, 100 feet wide at the mouth, with sides 250 feet long, gradually coming together near the middle and widening toward the rear end. Fish can enter the runway from two directions; in rough weather at the mouth, and in smooth from the rear. On each side of the runway the bank is high, and an observer can see if there be any fish in it. A white trader informed us that when fish have entered in

sufficient numbers the natives station themselves at the mouth and rear of the runway to prevent their escape, while others use the spear from the sides.

When the people of these islands see a strange ship in the harbor, their curiosity is aroused and all work is suspended. This often prevented us from seeing the different native methods of fishing.

TIKEI.

The following day a landing was made on this island. The shore line and beaches here are very rough and no attempt was made to operate the seine. A few crabs, an eel, and a balloon-fish were cap-

Stone Fish-trap, Apataki.

tured with a dip net. In a small pond of brackish water about half a mile from our landing-place, and near a cut through which the sea sometimes flows, were some 25 or 30 mullet; but none could be obtained, as the collecting seine had been left in the boat. There were no inhabitants on the island.

ROTOAVA, FAKARAVA ISLAND.

This is one of the most important islands in the Paumotu group. The *Albatross* remained here from October 10 until the morning of the 14th. The evening of our arrival a trammel gill net was set near the

ship in 7 fathoms of water, and a lobster pot was set close to the shore in 5 fathoms of water. The net remained down forty-eight hours and was visited morning and evening, and obtained a shark and one small fish, the same species as those taken in the net at Nukuhiva. The ground having been given a fair trial, the net was taken up and set near the edge of a patch of coral, part of the coral being awash at low water. One end of the net was set in shallow water and the other in about 4 fathoms, the foot line just clear of the bottom. Had any part of the net come in contact with the sharp, ragged bottom it is very doubtful if it could have been recovered. Numerous fish had been seen around the coral patch and the indications seemed favorable for capturing a number of them, but nothing was taken in the net, although it was down eleven hours.

Hand-line fishing was carried on from the dory on the edge of the above-mentioned reef or patch, taking four fish during an afternoon, all of the same species. No other kind could be induced to take the hook or come anywhere near it. A small trawl line, rigged with 120 very fine hooks and baited with pieces of fresh meat, fresh crabs, and fish, remained down long enough to convince us that nothing would be gained by leaving it longer. A place was selected for the trawl where the fish were plentiful, the water being clear and the bottom composed largely of white material, so that there was no trouble in placing the hooks just where desired. Some hooks ran at the base of branches of coral, others across little gullies, and a few on comparatively smooth bottom. It seemed as if one or more fish must be taken, but at the time we were not familiar with the habits of tropical fish.

The line attached to the lobster pot caught under a branch of coral and was cut off, thus causing the loss of the pot. A wire trap made after the pattern of those used in various parts of South America — that is, heart-shape, with the opening in the large end — was set in the same place where the trawl had been, baited with fresh fish and a live one for a decoy. This device also met with negative results.

The best results were obtained with a 15-foot collecting seine. It was hauled fully 50 times, covering a stretch of beach about 3 miles, from the village eastward. At all times great care had to be exercised in hauling it, the bottom in most places being covered with live coral. The places where the bottom was at all smooth covered small areas, and in these a man had to be stationed at the foot line to lift it over the coral. In many cases the seine could not be landed on the beach, but had to be gathered into a small compass and carried to the shore. The catch comprised half-beaks, pompano, flounders, and several other species of small fish not then identified.

On the reef outside the lagoon a fairly good collection of fishes was made with the dip net. A seine could not be used in the usual way. At low tide a platform of old beach rock is left partly bare; over this

the surf occasionally sweeps. On the platform are many small pools and miniature lakes, in which fish abound, having been left there by the outgoing tide. Sometimes when the sea breaks heavily against the outer reef a portion of the platform is covered to a depth of a foot or more, and fish may then be seen swimming in toward the shore. In walking over the platform small schools of fish were frightened from pools and out from under shelving coral. In a few instances the seine was dropped in front of them, they striking it before realizing that anything lay in their path, but only three times was this method successful.

The best results were obtained by turning over rocks in the pools and standing by with dip nets to capture any fish that might come forth. Altogether some 30 species were collected, the largest number yet taken at one place. Previous to starting on the cruise it was generally thought there would be no difficulty in capturing fish of every kind in great numbers at most of the South Sea Islands; but we soon learned that only occasionally can a collection be made representing many species, unless a long time be devoted to it, and of course this was out of the question.

We were told that on the southeast side of the island spiny lobsters in considerable quantities are frequently taken at night by the aid of torches carried in the hand and fires built on the beach. The light has a tendency to bring them forth from their hiding-places, when they are either speared or are captured with dip nets. Occasionally lobsters are found in the lagoon near the village. One evening while at Fakarava fires were built along the beach to attract lobsters, but none came out. The natives claim that only on the dark of the moon can lobsters be found; at other times artificial light will not attract them from their hiding-places.

The lobster is highly prized as food, and excursions lasting several days are made to obtain it, several families making up the party. It makes no particular difference how long they remain away from home, as on nearly all the islands forming the atoll huts are built to accommodate parties of this kind, and under any circumstances it takes but a short time to construct a shelter to fill all the requirements for temporary housekeeping.

In a small coral inclosure on the beach near the village were several large fish, all of the same species. They had been in the inclosure for some time, and were taken in the lagoon 5 or 6 miles offshore. They were said to be poisonous; but the same species caught on ground near the coast line were eaten almost every day. It was furthermore stated that most fish taken in deep parts of this lagoon were unfit to eat. Just why the same species of fish should be poisonous in one locality and edible in another, from places separated by only a few miles, is hard to say. One of the captive fish was caught and placed in alcohol.

At Papeete we were informed by Mr. Salmon, a native of Tahiti, that at a great many places in the Society and Paumotu groups certain kinds of fish were poisonous in some localities and good in others. In particular, on one side of the channel leading into Raroia the fish are good, but on the other side they are considered poisonous and are never eaten. The distance between the two fishing-grounds is less than a mile. The natives of the island do not advance any theory as to the cause, but merely state what experience has taught them.

To arrive at a definite conclusion regarding the poisonous qualities of these fish, considerable time would have to be spent in investigating the grounds. It is reasonable to suppose that in fish caught on grounds situated a long distance from the village and exposed to the heat for several hours before they are cleaned poisonous gases would form,

Stone Fish-trap, Anaa Atoll, on the Reef.

making the fish unfit for food. Many considered poisonous might be edible if cleaned before decomposition set in; but in the locality mentioned the two fishing-grounds are only a short distance from the village.

ANAA ATOLL.

Only a brief stop was made here. A party was landed in the dory, near the passage leading into the lagoon, to collect samples of coral rock. While on shore we saw a number of natives on the reef engaged in spearing fish in a stone trap. On a long coral reef situated between two small islands 11 of these traps were counted, 100 to 200 feet apart, facing in different directions and so built that fish could enter from the outside reef or from the lagoon side. At high water the reef is partially covered, and at times the sea breaks over it into the lagoon.

RAROIA ATOLL.

On the afternoon of the 16th the *Albatross* coasted off this atoll. There are a number of boat passages leading into the lagoon, but no channel large enough for a ship. The atoll is fast breaking up, and in many places the sea has cut through the reef and worn away portions of the islands. The main village is on the eastern end of the island. Several canoes and sailboats were noticed in the lagoon, and many nets were drying on racks. So far as could be observed from the ship, the beaches seemed to be better suited for operating a seine than at most atolls. The number of nets noticed indicated this to be the case. The rim of the atoll being considerably broken forms numerous channels through which fish can pass. Every feature of the lagoon and surrounding reefs pointed to its being a prolific fishing-ground.

MAKEMO.

From October 19 until the 25th the *Albatross* lay at anchor in Makemo Lagoon, during which time fishing and collecting was carried on each day. Near the passage leading into the lagoon, on the starboard side, is a reef about 1,800 feet long by 200 feet wide. The reef is awash at high water, and at times is a favorite fishing-ground. On the southeast side the reef makes off quite steep; on the northwest side with a gentle slope. On the reef were three fish-traps, built on the same general plan as those observed at other islands.

Most of the people were away engaged in the pearl fishery at Hikueru, and what reef fishing was done was by women and boys. We saw an exhibition of patience on the part of an old man seated on the top of a coral stone wharf engaged in enticing a fish from its hiding-place. The water was surging in and out through the crevices formed by the irregular shape of the coral rock. In one hand the man held a short stick, to which a piece of bait was tied; in the other hand he held a short gaff. Occasionally the fish would make a sudden dart at the tempting bait, usually getting a small piece, but always quick enough to escape the gaff. The man remained at his post nearly four hours before capturing the fish.

A lobster pot baited with fish and meat failed to catch anything. In the evening an occasional fish would be caught with hook and line from over the ship's side, but taken as a whole this method was not a success, only four fish being taken; one was said by the natives to be good; the others were pronounced poisonous. Hand-line fishing was carried on each day, but few fish were caught, with little variation in the species. They ranged in length from 8 to 22 inches. Specimens were saved.

Collecting with seine was carried on, but not always with encouraging results. In 50 trials 44 fish were caught, many of which had not before been taken by us. The result shows a great deal of work

for a small number of fish. Sometimes four or five hauls were made without taking a single specimen. In many places the bottom was quite smooth; but owing to the clear water the seine was visible a long distance, and this, combined with the natural shyness of the fish, caused seining to be abandoned. Satisfactory results were obtained only by stretching the seine across the mouth of narrow passages and driving the fish into it, a man being stationed at each end to lift it up when they crossed the foot line. Only a few at a time could be caught in this way, for they would invariably dart under rocks or hide under coral. Turning over loose rocks and bowlders was found to be a fairly successful way of capture. As this caused the water to become very muddy, the fish then would be as likely to dart in one direction as another in their efforts to escape, and a considerable number were caught. On another occasion when this method was employed 80 fish were taken, including 6 species not previously taken by us. The following day 100 fish were captured, and the next day fully as many more.

Several hauls were made with the seine on the beach near the outlet of the passage on the lagoon side, it being quite free from coral and other material injurious to a net; nothing was obtained. Previous to setting the seine fish were schooling near the shore, but they soon disappeared and did not return. Running parallel to the beach some little distance back, and almost hidden from view by a thick growth of vegetation, we found a slough about 30 feet wide and on an average 3 feet deep, in which fish were plentiful. The bottom and banks were composed of fine coral sand mixed with decayed vegetation. In many places were branches of cocoanut trees, which made it difficult to haul the seine. If an attempt was made to clear away the obstacles the fish scattered in every direction. By forming the seine into a kind of trap and driving the fish into it we collected a variety of species. At a deep pool near the mouth of the slough fully an hour was spent in capturing two beautifully colored fish.

Our experience showed that with our apparatus only a few fish at a time could be taken, the color of the nets, seines, and hand lines having considerable to do with the many unsuccessful trials.

A trammel net was set in 7 fathoms of water close to a coral reef. Fish were numerous around it, but nothing was caught.

In a narrow cut leading from the lagoon to the outside reef, through which the tide ebbed and flowed, a wire trap was set in 3 feet of water, baited with pieces of fish and a live fish for a decoy. In the cut were many holes, varying in depth from 5 to 6 feet and 10 to 20 feet across; some were much wider at the bottom than at the top, thus forming overhanging shelves under which fish lurked. Standing a short distance away, in a position commanding a full view of the openings, a sight was presented very much like a row of aquariums. A step or

two nearer and a general stampede would follow, and immediately not a fish was to be seen, and to all appearances they had made their escape; and such was the case so far as their safety was concerned. It was discovered that the fish could escape by a number of passages, in which they concealed themselves. An unsuccessful effort was made to frighten them out, standing by with a dip net to capture those that might appear.

The wire trap captured 2 fish on the first trial and 4 more on the second. The third trial gave very good results, amounting to 20 fish, representing 5 species. In the last trial the trap remained down twenty-four hours and contained 24 fish when taken up, among which were 4 species not before taken. By the different methods employed at this island 300 fish were taken.

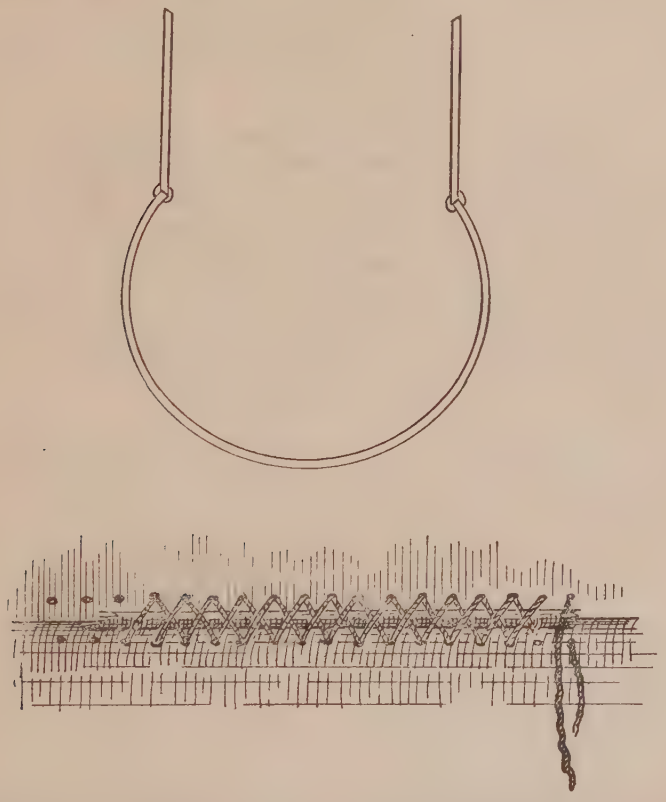
Shore collections were made on the outside reef, extending over a mile or more, and on the beaches in the lagoon. Among the material gathered were holothurians, sea-urchins, starfishes, shells, and crabs. The fringing reef on both sides of the passage leading into the lagoon is very rough, being composed chiefly of huge coral slabs, in which shallow places have been hollowed out by the action of the sea and are filled with water at each tide. In all these pools fish were noticed, but were hard to capture on account of the numerous outlets from one pool to another. Some, however, were taken and found to be the same species as those caught in the seine and trap.

The reef makes off from the beach about 500 feet. It is quite level, and when the tide is flooding the sea breaks on the outer edge and rushes in for a distance of several hundred feet, covering the reef to a depth of about 6 inches; receding, it leaves the reef bare except the pools, each incoming wave giving them a fresh supply of water. After a while the water begins to remain on the reef, only a portion of it running off. At this time fish are seen darting in various directions ahead of the incoming wave. Many of those that have been confined to the pools and channels now leave their narrow surroundings and mingle with other fish just in from the sea. At this time the natives usually repair to the reef to get their daily supply of fish.

Near the outer edge of the reef fewer fish were found in the pools than further up. Fish are abundant in gullies along the outer edge, where the reef makes off suddenly into the deep water, leaving many rough and jagged places 6 to 8 feet long and 2 to 4 feet wide, into which the sea breaks with considerable force even in moderate weather. Standing upon a shelf formed by the indentations fish could be seen at a depth of 10 or 15 feet. Frequently a heavy sea would surge in, churning the water into foam with sufficient force apparently to destroy all life within its reach. In some of these places the collecting seine was let down and held in position by the aid of a dip-net handle and a long pole, thinking that the surging might cause at least one fish to become entangled in the folds of the net; but before the

seine could be gathered up and brought to the surface the fish had either escaped into cavities in the coral or out to sea. We saw no exhibitions of skill in capturing fish with spear or other apparatus, and found no places on the reef where a seine could be operated.

But few canoes were seen on the island of Makemo, and only one well constructed and finished, that might be considered a representative type. Length, 17 feet; width, 14 inches; depth, 18 inches; the widest part 9 inches below the gunwale, just where the top and bottom join together; the bottom dug out of a single piece of hard wood, the



Showing cross-section of Makemo Canoe, and the way top and bottom are joined together.

top made of strips of soft wood. The two main parts, top and bottom, were neatly joined together with thread made of cocoanut fiber. Between the seams were strips of pandanus leaf, covered with a pitch substance which answers the same purpose as a thread of wicking. Both sides of the seam were covered with a strip of bamboo, and the seizings passing round the strips through holes bored three-fourths of an inch from the edge, each seizing crossing the other, forming a diamond pattern. The work was neatly done and looked strong and durable. The length of the outrigger was 15 feet, connected to the

canoe by three crosspieces. The float and other parts of the outrigger did not seem to have been made with any particular design; any piece of wood that was at hand seems to have been used. Bow of the canoe straight, with a sort of a billet-head projecting outboard; stern raking; bottom straight fore and aft and flat thwartships. This seems to be the prevailing style all through the Paumotus. The dugout part of the canoe was 1½ inches thick. It is no doubt necessary in these waters for the bottoms of canoes to be heavy, for in landing through the surf they are frequently subject to hard usage. Two other canoes measured 11 and 13 feet, respectively, and turned up considerably at the bow and stern; outriggers corresponding in size to the length of the canoes. These two canoes were painted blue, which did not add to their appearance.

Any departure from the original method of making detracts from the beauty of the canoes. Here, as at other islands visited, less attention is now paid to canoe-making than formerly. At one time the wood for every part was carefully selected, but little effort is now made to keep up to the old standard. In the place of neatly finished outriggers seized together with coir sennit, we find many of them poorly made and fastened with nails and pieces of wire. The large sailing canoe has been supplanted by sloop-rigged boats.

HIKUERU ATOLL.

On the morning of the 25th the vessel left Makemo and in the afternoon of the 26th lay to off Hikueru Atoll. This atoll lies 400 miles to the eastward of Tahiti and has a lagoon 10 miles in diameter. There is no passage leading into it, and canoes and other small craft are hauled across the rim from the outside beach. Canoes can be taken across without much trouble, but many of the large sailboats have to be transported on temporary ways. The distance is less than a quarter of a mile, with a good road all the way. The most difficult part is first landing the boats and canoes safely on the outside beach, out of the way of the surf.

The boat which took us in was 32 feet long and 8 feet wide, and sharp at both ends, steered with an oar, the same pattern and length as used in a whaleboat. This style of boat is chiefly for landing cargo from schooners that call at the island during the pearl-fishing season. The ordinary ship's boat would be of little service for this purpose, as in a short time she would either be smashed to pieces or have her bottom worn through by the ragged coral. Tons of freight are landed in a day, and so skillful are the natives in handling boats in a sea on a reef that an accident seldom happens to either boat or cargo.

Launching a boat through the surf is frequently more difficult than making a landing. In the former case the boat is almost carried over the platform reef to its edge. Those who are to embark take their

places in the boat, and when a favorable opportunity for launching arrives, from 10 to 12 men take hold of the gunwales and plunge her into the incoming surf. The bow oars have already been fixed in the rowlocks to keep her head to the sea until the others can be shipped. By this time the men on the outside are up to their waist in water, and sometimes they are carried off their feet by the undertow. To most people this would be a very serious matter, but to a native it signifies but little. The outer edge of the reef is very sharp and ragged, and should a boat be caught under it as the sea falls off the platform she would either capsize or be dashed to pieces against the coral by the next incoming sea.

THE PEARL FISHERY.

There are many other islands in the group where pearl fishing is carried on, but Hikueru is the most important. The fishery is regulated by the French government, the lagoon being thrown open every third year. Only one lagoon is fished at a time, and in consequence all divers assemble at one place. This year (1899) being the open season for this island, natives from almost every island in the Paumotu group are represented. Three firms control the fishery—one French, a German, and an American firm. This season fishing commenced October 5, and 55 tons of shells had been taken up to October 27. The last season the lagoon was fished, 380 tons of shells were taken out. From this amount $3,000 worth of pearls were found. As compared to other parts of the world where pearl fishing is carried on, it is said that this amount of pearls is small for the quantity of shells taken. Here the finding of pearls is incidental. The main object is gathering the shells.

For a number of years "machine diving" was carried on—that is, the men dressed in diving suits. By this process a much greater amount of shells was taken each season. Thinking that this method was fast exterminating the fishery, a law was passed prohibiting it, since which time all diving has been performed in the original way of going down naked. Diving is performed in depths ranging from 5 to 20 fathoms, the average probably being 10 to 15 fathoms.

Each company employs its divers for the season; they are bound by contract to fish for no other company, and are paid so much a ton for shells, the price being governed by the quality. The shells are divided into three grades. First-class shells are worth $1,500 to $1,800 per ton; second-class, $1,200 to $1,400, and third-class frequently less than $1,000, sometimes as low as $250, Chilian money. The prices vary to some extent each year, according to supply and demand. Germany is the principal market for pearl shells and pearls, the price for both being regulated in that country and forwarded to agents at Papeete before the season opens.

All pearls belong to the divers finding them, they having the privilege of selling to the highest bidder. Usually they sell to the firm employing them. On the strength of the high wages earned, each season there is a considerable rush to the lagoon where pearl-diving is to be conducted. At the time of our visit there were 3,500 natives either directly or indirectly engaged in the fishery, many of them from distant islands.

In moving from their homes the natives bring a large portion of their household effects with them—in some cases even the houses they are to occupy. The houses are very light, made of cocoanut palms and pandanus leaves, put together in sections and easily transported. The representatives from different islands form separate settlements, and for a distance of several miles along the beach clusters of houses and small villages are built among the cocoanut palms. The various villages are in every way the same as if they were located on the island homes of the people occupying them. Women and children are brought to the island and housekeeping goes on in the usual manner. Many of the women and young girls take part in the diving, and we were informed that they are equally as good divers as the men, in depths not over 10 or 12 fathoms.

Besides those engaged in the fishery, many native and a few white traders deal in pearls to some extent, but chiefly in articles in demand by the fishermen. A generous portion of the wages earned by the divers finds its way into the hands of the trader. The natives, both male and female, are fond of display, and gaudy patterns of goods are purchased to a much greater extent than seems necessary.

On Saturday hardly any work is performed. During the afternoon trading is extensively carried on, and in the early evening preparations are made for a grand dance and good time generally. Early Saturday morning canoes and cutters begin to arrive at the main village loaded with people from all parts of the lagoon, coming to remain over Sunday and take part in the festivities. We were informed that it was not unusual to see 100 or more anchored in front of the village. We were advised to remain over Saturday, being promised a unique entertainment.

Pearl-diving is carried on in all parts of the lagoon where the water is not too deep. The right depths are found near the coral patches, many of which are awash. These coral growths vary in size, from 10 to 15 feet across the top, others 100 feet or more, descending with a gradual slope, pearl shells being found around their base. Numerous coral patches are scattered along the inner rim of the atoll, from ½ to 1½ miles from the beach. Many were noticed farther offshore, but we saw no fishing going on near them.

Every part of the lagoon is free to all divers, no one company having exclusive rights or privileges. Divers employed by different companies

can work together on the same ground if they choose, and sometimes do, but as a rule they prefer not to interfere with each other.

Shortly after our arrival, arrangements were made to visit the pearl-diving grounds situated about 8 miles away. We took passage in one of the small cutters employed in the fishery, and on arriving at our destination made fast to a cutter anchored over a submerged growth of coral. Two other cutters were at anchor close by. Three divers were on one boat and five were on the other, one of whom was a woman. Each of the divers is provided with a water-glass, with which he scans the bottom before going down. The glass is similar to that used by the fishermen of Papeete, with a notch in the side in which to rest the neck. It is 16 inches square at the top, 12 inches at the bottom, and 12 inches deep. By its aid the bottom can be seen to a depth of 20 fathoms, and shells located. Before diving in deep water the bottom is inspected through the glass. By locating a clump of shells before going down, much labor is saved. Instead of the diver exhausting his energy in diving at random and searching for shells after reaching bottom, he goes directly to the spot where the shells lie. At other times, in shallow water, he goes down to explore the bottom. In this way clusters of shells are located before any are taken.

Before descending, the divers sit around on deck for some little time inflating their lungs to the fullest capacity, exhaling the air through the mouth, making a low whistling sound. No clothing is worn except a breechcloth. Over the shoulders is carried a bag net in which to put the shells. The net is made of cocoanut fiber, about 20 inches deep by 12 inches wide; size of mesh, 2¾ inches. It offers little resistance and will carry all the shells a man can bring to the surface. In the left hand is carried a pearl shell, which serves the same purpose as a knife. With it obstacles are removed from the bottom and shells loosened from their bed. The right hand is protected by a white cotton mitten; sometimes cotton cloth is wound around the hand.

When ready to descend the diver slips over the side of the boat, holding to the rail with one hand and having a water-glass in the other. Locating some particular point at the bottom, he lets go of the rail, drops the glass, takes a deep breath, and sinks out of sight feet first. Descending about 10 feet, he quickly turns head downward and swims to the bottom. A water-glass distinctly discloses every movement, his brown body forming a striking contrast to the clear water and variegated colorings of the bottom. When hardly a third of the distance has been reached he has the appearance of being on bottom, so transparent is the water. On reaching it he places himself in a horizontal position, seemingly hauling himself along from one point to another. For some time active diving was carried on in comparatively shallow depths, from 10 to 12 fathoms.

One man consented to give an exhibition dive in deep water. The

cutter was dropped off a short distance from the shoal and a sounding made in 17 fathoms of water. We watched through water-glasses the diver's movements from the time of sinking below the surface until rising to the top again, two minutes and forty seconds. One shell was brought up. Long before reaching bottom we thought it would be impossible for him to accomplish the feat, but in this we were mistaken. Reaching his destination, he began picking over pieces of coral, brushing aside stones, broken shells, etc., in the same manner as if he were at work in a garden. He investigated the bottom some 60 or 70 feet from the initial point of landing. When ready to ascend he stood erect and came up as if being pulled with considerable force, shooting out of water halfway to the waist. He seemed to suffer no unusual discomfort, and in a short time was ready to go down again. There is a record of a dive of 23 fathoms. The length of time the diver remained down we did not learn.

Canoes are very little used in the pearl fishery, being of little service as compared to the boats. The boats are cutter-rigged, easy to handle, and capable of carrying considerable cargo. They are mostly built on the same design, there being hardly any appreciable variation. All those examined were keel, straight stem, square stern, and carvel-built, with a cock-pit aft. They have accommodations in the cabin for about four people and in the hold can carry a considerable quantity of freight. Between the trunk of the house and the rail is a walking space of 14 inches. Measurements were taken of two of these cutters. One was 16 feet long, 6½ feet wide, and 2 feet deep. The other was 23 feet in length, 8½ feet in width, and 2¾ feet in depth. Other and larger cutters were seen at anchor some distance from the beach. Each cutter carries a small tender. There are 350 boats engaged in the fishery. The cost of an average cutter, about 22 feet over all, rigged and ready for use, is $350. They are built in Papeete and owned largely by the companies operating the fishery.

We saw but few canoes. Those examined were superior to many observed at other islands. The top and bottom are made of separate pieces, the upper part of soft wood and the lower of hard wood, and fastened together with line made of cocoanut fiber, the seams having strips of pandanus leaves between them. In length the canoes varied a foot or two, in width a few inches. One was 9 feet long, 10 inches wide, and 16 inches deep; outrigger float 7 feet long, 4 feet from the side, and 5½ feet between the stanchions connecting the crosspieces to the float. Another canoe was 11 feet long, 11 inches wide, and 18 inches deep, built the same as the first. They were round on the bottom and straight fore and aft. There were no paddles lying about, neither were there any sails. In the lagoon there must have been many types of canoes, but as the people owning them were so widely scattered we saw only a few.

AKIAKI ISLAND.

On October 30 we touched at Akiaki, a small island not over a mile in circumference. It has considerable more soil than most islands visited in this group and is covered with a heavy growth of vegetation. No collecting of fish was done, our time on shore being limited to less than an hour. There are no permanent inhabitants, but the number of turtle here attract natives from adjacent islands. As fast as turtles are caught they are taken to the middle of the island and placed in a small pond, where they are kept until a sufficient number have been captured, when they are taken away alive and sold.

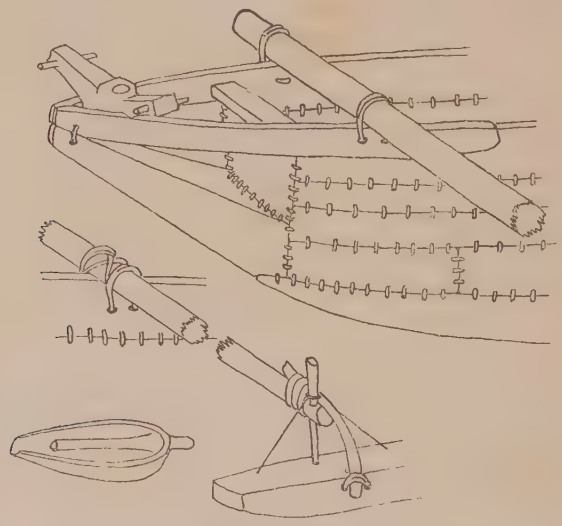
NUKUTAVAKE.

About an hour was passed here in collecting specimens of coral rock and other material. The inhabitants, numbering possibly 100, live entirely by themselves and seem to be contented. There are no white people among them. The village is built close to the beach, as is usually the custom in the South Seas. The houses, canoes, and everything connected with the village had the appearance of having undergone little change through the introduction of modern things. As near as we could learn, no white men had ever lived among these people, but they, of course, had come somewhat in contact with white people at different islands. The houses are neatly built and a great deal of skill is exhibited in decoration, the interior in every way corresponding with the outside.

Mr. A. G. Mayer made a sketch showing half of a canoe, illustrating all the essential parts. Length, 17 feet; width, 3¾ feet; depth, 2½ feet; very sharp on the bottom and having a great deal of dead rise. The bottom, or that part of it corresponding to the keel and garboard strake of a boat, was made of one piece, dug out of a log. The outrigger float was 19 feet long, 12 inches wide, 8 inches deep, flat on the under side, and turned up slightly at each end and attached to the frame 9 feet from the side, which gives the canoe considerable stability. The crosspieces forming the framework project outboard on the opposite side 3 feet and are fastened to the gunwales with coir sennit. The stanchions connecting crosspieces with outrigger float, 20 inches long, are seized together with sennit and braced fore and aft with the same material and counterbraced just inside the stanchions with a stout withe; the outer end of brace is fastened to the outside edge of float, the seizing passing through holes about 3 inches apart. The holes are formed on a curve, one leading into the other, deep enough to give the required strength.

The canoes showed original design and workmanship of a very superior quality. All canoes examined at other islands were crude as compared to these. The Nukutavake canoe is put together in somewhat the same manner as a boat or vessel, the construction being

altogether different from the ordinary dugout or the canoes at two places previously mentioned. The accompanying sketches will show the build, model, and neat workmanship. No metal is used; the planking and other parts are seized together with the usual cocoanut fiber so universally used throughout the South Seas. The seams of the planking are covered with bamboo strips, and between them is a coating of gum and narrow strips of pandanus leaves. Each canoe has two sets of floor timbers, one set 3 feet from the bow and the other 6 feet from the stern; also a mast step, the mast partner situated just aft of the forward crosspiece and fitted to the gunwales. On one canoe a temporary bowsprit was rigged, the heel of which was fastened to the underneath side of crosspiece. We saw no masts, sails, or paddles.



Canoe, Nukutavake.

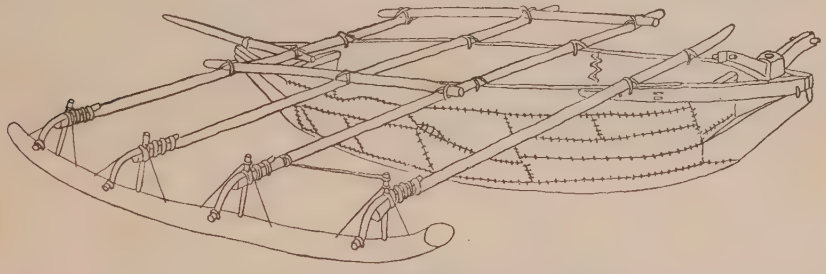
The measurements of two other canoes were taken, of essentially the same design as the one described except the outrigger float, which was round and more curved, the forward end round-pointed, the after end square. The first was 14 feet long, 2 feet wide, and 23 inches deep; very sharp on the bottom and a slight turn of the bilge; no floor timbers. The outrigger frame consisted of three crosspieces. The second was 13½ feet long, 3 feet beam, and 2 feet deep. Being a foot wider, this canoe had a more rounding bilge. The bow and stern are alike. A head rail extends out from the main body of the canoe 2½ feet, to which the forward and after crosspieces are fastened, and from the keel a cutwater runs up and connects with the head rail, giving strength and adding considerably to the general appearance. The cutwater is made of one piece of wood, and, as will be observed in the sketch, is neatly fitted to the keel, planks, and head rail. The cleats at the stern are for making fast the sheet and for placing the steering

paddle against when going through the surf and narrow passages. Two braces, one forward and another aft, answer as thwarts. Heavy material is stowed in the bottom, and the occupants arrange themselves on the two thwarts and framework of the outrigger.

We saw no tools of any kind lying about, and the time being short we had no opportunity of investigating among the houses for such implements as are used in building either house or canoe.

Getting out the planks, head rails, cutwater, and outrigger float from the rough log, made smooth and fitted so perfectly without the use of modern tools, must indeed be a long and laborious task. The tools used are evidently crude, for long before the coming of the white man to this region, when visits were frequently made to distant islands, it is said that canoes were made larger and superior to those of the present time.

The outrigger floats are of hard wood and have the appearance of being heavy. The style of bailer is the same as found at other islands.



Canoe, Nukutavake.

A strong feature which presents itself in favor of the built canoe over that of the dugout is that under most circumstances it is likely to be more serviceable. In case of the latter having a plank smashed or a section of the bottom torn off it is comparatively easy to replace it. If the dugout meets with a serious accident, such as splitting open the bottom or having the bow or side smashed in, either one of which is likely to occur, the work of repairing the damage is considerable.

At most of the important islands in the Paumotu group schooners and cutters have taken the place of the large canoe. Much quicker passages can be made in them, and since the gathering and shipping of copra has expanded and become a permanent business, and is to some extent carried on by the natives, the schooner and cutter have been more in demand.

WHITSUNDAY ISLAND.

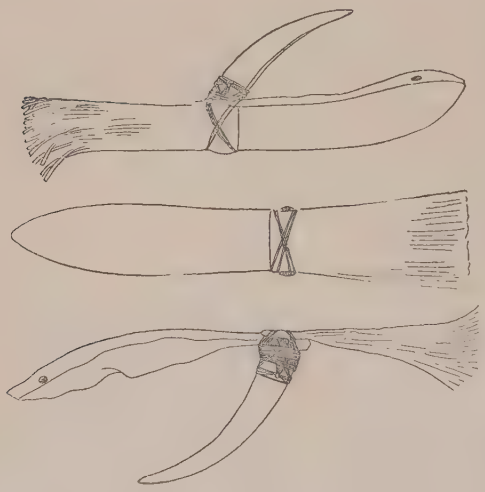
On October 31 the ship lay to off Pinaki or Whitsunday Island, situated but a short distance from Nukutavake. The island is small and uninhabited, but is visited occasionally by people from neighboring islands. A boat was lowered and a landing made near the passage

into the lagoon. The passage, which is about a third of a mile long and 200 feet wide, runs nearly dry at low water; at high water a small boat can enter. Some fish were seen in the passage, but none in the lagoon.

Strewn along the beach of the lagoon were numerous tridacna shells, in some places heaped up in long rows; and scattered over the lagoon there were counted 116 piles of shells, which at a distance resembled haystacks covered with canvas. At one end of the lagoon, about 110 yards from the beach, was a platform erected upon posts, probably for drying the meat of the tridacna. We could see no reason for using the platform to dry copra, it being too far from the shore, and besides there is only a scant growth of cocoanut trees on the island.

HEREHERETUE ISLAND.

On the morning of November 3 the *Albatross* arrived off this island. It is situated 370 miles to the westward of Whitsunday, and is quite isolated; the nearest island to it (Anu-Anuraro) is 90 miles to the eastward. A party was landed and a visit made to the village. A wide, fringing reef makes off in front of the village, on which are pools and miniature ponds at low water. One fish was captured in a dip net.



Fish-hooks, Hereheretue Island.

Few people were on the island; we were informed that many were at Hikueru, engaged in the pearl fishery. We saw no people fishing, either on the reef or from a canoe. A native who could speak a little English told us that fishing is done only with hook and line and with spear. Hooks are made from the pearl shell. A piece of shell is formed into the shank of the hook by rubbing it against a stone; the bow is made of bone, and sometimes shell, and sharpened to a point in the same manner as the shank. Holes are drilled in both, and fastened together with cocoanut fiber.

On the lower part of the hook is fastened a bunch of goat's hair, and sometimes narrow strips of pandanus leaves, to attract fish. The body of the hook is highly polished, and can be seen in the water for a long distance. There being no barb on the hook, a fish can be captured only by keeping the line taut, not allowing it to slack in the slightest degree.

CANOE, MAKEMO.

CANOES, PADDLE, DIP NETS, AND FISH CAR, PAPEETE.

The hooks vary from 3 to 6 inches in length, and are used both for trolling and bottom fish. In trolling the bare hook is used; for bottom fish, bait is tied round the bow and shank, leaving the point exposed. Fishing at the bottom is very destructive to hooks and lines; a large supply was noticed in the houses.

Two very poor dugouts were lying upon the beach, the best canoes being probably at Hikueru. The larger of the two was 16 feet long, 18 inches wide, and 12 inches deep. The outrigger frame was built out 5 feet from the side. Outrigger float 12 feet long, crosspieces of frame 9 feet apart. The outrigger frame was made of tree branches, and fastened together with bits of old string and wire. Bow of canoe quite blunt; stern sharp. It would seem that the shape of these canoes is governed rather by the shape of the log from which they are made than by any particular design. Both canoes were fitted with a sprit sail and temporary shrouds. The shrouds were made fast to the crosspieces and were unfastened each time the sail is taken in. The indications are that these people are fast discarding their own methods and adopting new processes in canoe-making.

THE SOCIETY ISLANDS.

The *Albatross* arrived in the harbor of Papeete, island of Tahiti, on the afternoon of September 27 and remained there until October 5. Fishing was carried on with hand lines, gill nets, and seine, but the results were meager. It was found that fish would seldom take the hook, however tempting the bait might be. Wire fish-traps were made and set in shallow water where fish were known to be plentiful. They remained down several days with negative results. Each time a trap was visited several species of fish could be seen swimming about as if investigating the contents, but their curiosity did not lead them into it.

A crab net and a lobster pot were set off the northern end of Motu-uta Island; nothing was taken in them. One afternoon in this locality we succeeded in taking three fish with hook and line. Trials were made in the same place the following day, but nothing was caught.

The beaches in the harbor are composed principally of coral and old beach rock, to such an extent that it is almost impossible to find a place where a seine can be hauled without injury. Fish of many varieties were observed in all parts of the harbor, particularly on the spots where the traps were set. A trammel net was set off the northern end of the coral reef fringing Motu-uta Island, in $3\frac{1}{2}$ and 5 fathoms of water, the deepest part being on the outer end. The net remained down thirty-six hours and during that time was "under run" several times, but although fish were noticed in the vicinity of the net none was obtained. The clearness of the water was no doubt the cause of fish not entering the net.

We soon learned from observation and by personal experience that we could obtain but few fish with our apparatus. Nearly all of the fishing in the immediate vicinity of Papeete is performed with spears (usually single-pronged) with the aid of an ordinary water-glass. This fishing is generally conducted at half tide on the coral reefs, where the water is 3 or 4 feet deep; early in the morning, when the tide serves right, is the best time. Naked, except a cloth about his loins, with spear in the right hand, a water-glass in the left hand, and the painter of the canoe tied around his waist, the fisherman picks his way over the reef. The canoe is towed along to put the catch in, and also to paddle over deep places, and for crossing to the outer reef if necessary. The water-glass is such as is in common use everywhere, a foot square at the top, 12 inches deep, tapering to 8 inches square at the bottom, in which is set a piece of window glass. In one edge of the top a semicircular place is cut in which to rest the neck. The fisherman places his head inside and pushes the box ahead of him, carefully scanning the bottom. By the aid of the glass any fish that may be lurking near can be distinctly seen. The progress over the bottom is necessarily slow, as each step is likely to bring forth a number of fish, and to hurry would greatly lessen the chance of capturing one. Coral fishes are very shy, and the least movement on the part of the fisherman causes them to dart under branches of coral, into some hole near by, or to conceal themselves under the many overhanging shelves which mark the dividing line between shallow and deep water.

In order to catch fish in this manner it is necessary to be familiar with all parts of the reef and to know just where the kinds of fish sought are to be found at different periods. A lifetime of experience has taught these people to become very expert, but with all their skill no great amount of fish is caught at one time. Sometimes a fisherman will be an hour or more traveling over the rough bottom up to his arms in water, and during that time cover a mile or more without capturing a single fish, but as he has plenty of time at his command it matters little whether he uses one hour or a half day in obtaining the amount of fish desired. It is astonishing how these people can travel in bare feet over the sharp and jagged coral. One shod with stout shoes finds it difficult to make much headway even in comparatively smooth places.

About 2 miles north and east of the town there is a small stretch of beach where drag-seine fishing is carried on to a limited extent. The fish taken are for home consumption. The length of the seine corresponds to the size of the beach. Two of them were measured, one 5 and the other 10 fathoms long; 10 and 15 feet deep; size of mesh, 2 and 3 inches, stretch measure. For floats pieces of wood are used, of no regular form or size; on the foot-rope pieces of sheet lead are wound. On one small seine, made of coarse mosquito netting, blocks

of wood were used for floats, and to the foot-line were fastened shells for sinkers. The seines had no bags and were hauled without seine ropes, in the same manner as a small collecting seine. They are used mostly by women and children.

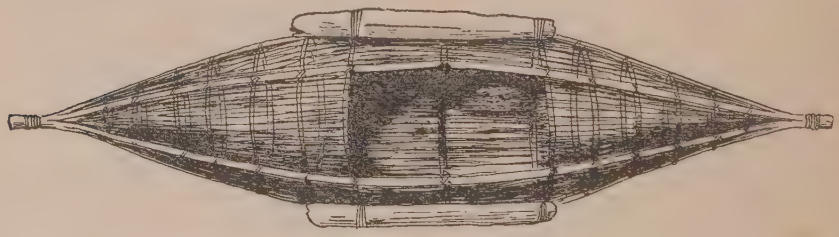
At Point Venus, 5½ miles from Papeete, is a seining-ground where a large seine is operated by Gilbert Island fishermen. These people settled here a number of years ago as a fishing colony. No description can be given of the seine or other apparatus, as no visit was made to that locality. About 8 miles to the westward of Papeete is a fishing village of considerable importance, inhabited by Gilbert Islanders. We learned that most of the fish in Papeete market are caught by these people. Their homes are scattered along the beach for several miles, there being no method displayed in laying out the village. On beaches where seines can be hauled houses are built near the water's edge. They are mostly hidden from view by the dense growth of trees, and many times we were about to pass on, thinking there were no inhabitants near, when our attention would be attracted by a net or fish trap among the trees. On making an investigation we usually found a house or two, and more apparatus. The people were kindly disposed, and tried in every way to explain the manner in which the fishing gear was used, but without much success, as they spoke only their native tongue.

It being Sunday, no fishing was going on and we were unable to see any of the apparatus operated. Arranged along the beaches were racks on which seines were drying. The seines varied in length from 60 to 120 feet; 30 to 44 meshes deep; size of mesh, 3 inches; single head and foot line; floats on the head-line made of koa, a wood that is very light and more durable than cork. The floats were 4 inches long by 2½ inches in diameter, placed 5 inches apart. The leads on the foot-line were 3 inches apart, made of heavy sheet lead and wrapped around in Italian style. This is a very good way to lead a seine, for should there be too much lead it is easily removed, and on the other hand if there be not enough it is easy to put more on.

We were informed that all the webbing used in making nets is imported from San Francisco. The water being exceptionally clear, tanned nets are not used. The less conspicuous a net is in the water the more fish it will catch. All tropical fish are shy, but those inhabiting coral reefs are unusually so. No gill nets are used.

Bamboo fish-cars of various sizes, which at first we supposed to be fish-traps, were noticed. The largest was 7 feet long and 3 feet in diameter across the center, gradually tapering to 4 inches on the ends. The length and shape depend on the size of the bamboo from which the car is made. Bamboo of the desired sizes is selected and split longitudinally between the nodes into strips about one-half inch wide, care being taken not to separate the ends of the strips from the nodes. The

stick having been divided into as many strips or sections as required, an opening between them is made and a wooden hoop, about 4 inches in diameter, is inserted, turned at right angles, and gradually forced into one end. This causes the openings to spread. The first hoop now being in position, a larger one is put in 1 foot from the first. This admits the large middle hoops, which are placed 7 inches each side of the center. The strips are now stretched apart to their fullest capacity, with a space of 3 inches between them. To prevent small fish from making their escape the openings are reduced one-half by inserting other strips made of the same material, the ends held in place by a serving of cocoanut fiber, and fastened to the hoops with the same material. In the top of the car is a door 15 inches square, and on each side of it, lengthwise of the car, is a piece of koa wood, 2 feet long and 3 inches in diameter, serving as a float and keeping the door of the car always at the surface. The cars are light and durable; they are made for towing, and both ends having the same shape they offer little resistance to the water.



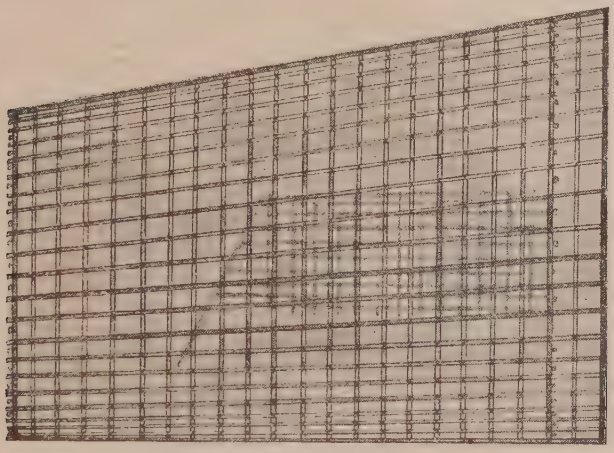
Bamboo Fish-car, Papeete.

Live-cars are very necessary in these waters, for fish deteriorate quickly and will keep but a few hours at most. Those caught in the afternoon, unless placed in a car, are not fit for market the following morning. When a distant fishing-ground is visited a car is taken into the canoe, and if fish are caught it is towed back. Cars are always kept ready for use; when containing fish they are anchored in some sheltered place where the water is smooth.

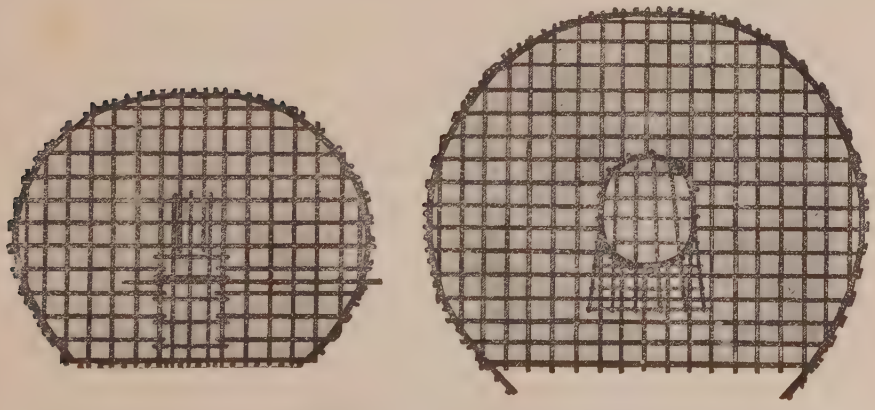
Trap fishing is followed by these people to a considerable extent. We saw several traps, all of the same type and size, $2\frac{3}{4}$ feet long; one end 2 feet wide by 1 foot deep, the other 2 feet wide and 18 inches deep; straight on the sides and ends, oval on top and flat on the bottom. They are made of withes and seized together with cocoanut-fiber twine, forming a network of meshes $1\frac{1}{2}$ inches square. The top extends out over the front end 3 inches; this probably is purely ornamental. The funnel or lead is 19 inches long and 6 inches square at the opening. Just inside the mouth it is oval in shape, gradually tapering to a point. The last 6 inches on the bottom side of the funnel is open; the extreme end is closed. This forces the fish to find their way into

the main portion of the trap from the underneath side of the funnel. In trying to find a way of escape from a trap, fish usually seek places near the middle or top, and by having the outlet concealed near the bottom, there is little chance for escape. The fish are removed through a door in the rear.

Traps are set both in shallow and deep water, near the edge of coral patches, or further offshore, in deep water, close to the fringing reef; also in ravines, runways, and holes among the coral, where the choicest



Fish-trap, Papeete, Side View.



Fish-trap, Papeete, End Views.

of fish exist, that can not be caught except by trap. A trap may be set in a well-selected place for 24 hours or more, without taking a single fish; and then again a dozen may be caught in a few hours. Fish inhabiting waters adjacent to coral reefs are very erratic, and a fair catch made in a particular locality one day is no sign that the same thing can be repeated the next day.

It is stated that no natives of Tahiti use traps of their own inven-

tion, and that a great many of the fishing devices have been introduced by the natives of the Gilbert Islands. It is probable, however, that before these people came to the island the natives paid more attention to fishing than they do now.

Torch fishing is carried on almost every evening when the weather is favorable. Soon after the sun sets the canoes paddle across the harbor and out through the passage in the reef. The fishing-ground being reached, torches of cocoanut husks are lighted. Both the large and the small fish are attracted; the large ones are speared, and the small ones taken in dip nets. Back and forth, about a half mile off the reef, the procession of torches may be seen far into the night. At certain seasons considerable quantities of flying-fish are captured by "torching." We were told that on these excursions the fish-car is frequently brought into service.

If fish are plentiful in the first part of the night, and "torching" has been a success, the fishermen leave the ground early; but if they are scarce, the morning is well advanced before the work is abandoned. Just at the break of day the fishermen bring in the night's catch and the fish that have been held over in cars. Groups of men and boys may be seen coming along the road with large baskets slung over their shoulders filled with fish. Occasionally a team is seen laden with fish, but for the most part the carrying is done on the shoulders. Long distances are covered, partly by canoe and the rest by foot. Many fishermen, however, land their catch in canoes on the beach in front of the town, and then take it to the market.

In the market, located in the middle of the town, there is a considerable variety of fish displayed in amounts of 50 and 100 pounds. It is a large 1-story building with the sides open to admit the free circulation of air. A portion of the floor space is divided into small stalls. There are also long tables arranged along the floor, on which the fish are placed before the customer in wrappings of fresh leaves and in baskets made of cocoanut leaves.

The price of fish varies from day to day, according to the supply and demand. As a rule, fish of all kinds bring high prices, owing to the difficulty of catching them and their rapid deterioration. Ice is too expensive for use, and even if it could be had here at a reasonable figure the chances are that very little of it would be used on fish.

The canoes of Papeete vary but little in shape and are similar in construction to those observed at Nukuhiva, previously mentioned. The art of canoe-making has rapidly declined since the island has been ruled by Europeans. Previous to that period and for some time after, the building of canoes was one of the principal occupations of the people throughout the Society Islands and Paumotu group. Skill of no mean quality is exhibited in the old-style canoe, now only seen in private collections. They were large and composed of many pieces,

and great care was taken in decorating the war canoe with carvings and shells. The canoe for common use was far superior to most of those now seen among the islands adjacent to Tahiti.

The average length of the canoes measured was 23 feet; 19 inches wide and 18 inches deep, width carried well forward and aft; outrigger 18 feet long, 6½ feet from the side of the canoe; 13 feet between crosspieces leading to outrigger, the forward one connected with it by a stanchion 12 inches high, the after one leading directly to it and fastened with the usual cocoanut fiber. The stanchions are braced with withes. Wire is sometimes used.

There seems to be no special pattern for the outrigger float. All styles were noticed—round, square, some sharp on the forward end and others blunt. The main body of the canoe is quite symmetrical, yet there is a decided lack of finish.

Both long and short handled dip nets are used. The bow is 2½ feet long by 1¼ feet wide; size of mesh 3 inches. The web is made of cocoanut and pandanus fiber. The large nets are of the former and some small ones of the latter material. The net hangs about 14 inches below the bow on the outer part and not over 3 inches on that part next the handle, thus forming a kind of a pocket. The nets are necessarily very light, for they must be handled very quickly when fishing with them on the reef and from the canoe.

Canoe-bailers are made of one piece of wood, and are shaped like a hand flour-scoop, except that the bottom is nearly flat. The handle is on the inside and projects from the top horizontally toward the mouth. By having the handle on the inside the person who is bailing can work much longer without the hand becoming cramped than would be possible with the ordinary boat-bailer. The size of bailers examined was 17 inches long, 7 inches wide, and 3 inches deep. To make a bailer of this kind with tools such as were formerly used must have been slow and tedious work; but with modern tools at hand it is quite a simple matter; yet the introduction of modern tools has not improved the workmanship of anything connected with the canoes.

It has been mentioned that large canoes have been mostly supplanted by clinker-built boats varying in length from 30 to 40 feet; 32 feet is about the average length, 5 to 6 feet wide, and 2 feet deep. Square stern and straight stem is the prevailing style. They are keel boats, straight on bottom, with little sheer. They are rigged with spritsails and carry two masts stepped well aft, with shrouds permanently fixed to masthead, temporarily set up to eye-bolts in the gunwale. They are well supplied with thwarts, generally seven, followed by large stern sheets.

We were informed that these boats were all built by the natives. Good workmanship is displayed in every detail, showing that what they have lost in the art of canoe-making has been made up in modern

boat-building. The cost of a boat all rigged is $250. No fishing is done in them, but they are used in making passages to distant parts of Tahiti and the island of Moorea. The people of Moorea have the same kind of a boat, and it is not unusual to see a dozen or more of them lying at anchor off the beach in the harbor of Papeete, loading with general cargo, such as can be carried in an open boat. The weather at most seasons of the year being pleasant, passages from one island to another are made with safety. Many parts of the coast line of Tahiti are protected by outlying barrier reefs, inside of which canoes and boats can navigate in smooth water when it is choppy outside.

From November 6 to the 15th the *Albatross* again lay in the harbor of Papeete. This time less general collecting was done than during our previous visit. The material collected at the various islands was packed and made ready for shipment to Washington.

Wire fish-traps were set on the reef in shallow water off the southeast side of Motu-uta Island, remaining down from the 7th until the 14th. After having been set 24 hours they were hauled, but nothing was in them. At the end of two days two of the traps were shifted farther in on the reef in shallower water. Here nothing was caught, and they were shifted back to where they were first set. Nothing was taken until the third day, when 4 fish were found in them, and immediately following these 11 others were caught, all in traps having live fish in them for a decoy. The first decoy was caught on a hook; the first four specimens taken in the traps were also used for decoys.

However plentiful fish may be around a trap, they seldom enter it the first day or two. It has to be carefully investigated from a distance until a certain amount of confidence is gained before approaching nearer. Native fishermen rarely visit a trap under four or five days from the time it is set.

On the morning of November 15 the ship left Papeete and steamed over to the island of Moorea, where it lay to off the northern end during the afternoon and part of the evening. In the afternoon several schools of horse mackerel passed by, followed by large flocks of birds.

The following day we skirted the shores of Huaheine, Raiatea, and Tahaa islands. In the passage separating Raiatea and Tahaa a large number of canoes were engaged in fishing. The islands are circled by a barrier reef forming a channel from a half to a mile wide. In the evening the ship anchored in Hurepiti Bay on the southwest side of Tahaa. At the entrance of the passage were two natives fishing with spears; they were up to their knees in water and towing their canoes after them. The shore in all parts of the bay is very precipitous, cocoanut trees and other vegetation growing to the water's edge. The beaches are narrow and steep and at high water are covered. Only a few huts were visible from our anchorage, and they were built on piling over the water.

The surface electric light attracted a number of small fishes and several forms of crustacea. A crab net and wire fish trap were set, but neither took anything; the former was hauled repeatedly, the latter was taken up in the morning.

BORA BORA.

This is one of the important islands of the Society group, situated 10 miles from Tahaa. The village has a population of about 750 people. One day was spent here collecting and gathering information. Very little fishing is done near the village; the principal grounds are on the west side of Tupua Island, 2 miles distant. We were informed that a number of stone traps were located on this part of the island. The beach on the north and west sides is said to be free from coral and rock and a suitable place for operating seines.

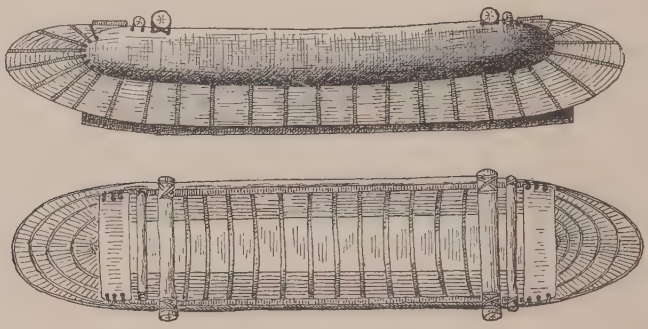
Fish are taken here by hook and line, seines, and traps. Seines vary in length from 100 to 150 feet; 2½ fathoms deep; mesh, 2½ and 3½ inches. One of the seines measured 60 feet in length, 12 feet deep, 5½-inch mesh. For floats pieces of koa wood are used, and for sinkers pieces of coral rock are fastened at regular intervals to the foot-line. These seines are operated in two ways—dragged ashore on the beach and used as a kind of a trap. The seine is carried on the shoulders of the fishermen to the place where it is to be set, and dropped gently into the water, forming a semicircle, sometimes the mouth facing offshore and at other times inshore, this being regulated by the position of the fish; one man stands at each side of the mouth, holding the ends, and two are at the bunt; several canoes are stationed off the mouth, and a number of men form a line between the canoes and the mouth of the seine, thus forming a lead; everything being ready, the canoes slowly approach the net, keeping the paddles splashing all the while to frighten the fish toward the seine. Some of the fish will, of course, escape, but the continual kicking and the splashing of the paddles has the effect of driving others into the net. The seine is then closed up, the foot-line drawn together, picked up, carried to the shore, and the contents placed in live-cars.

Live-cars serve to carry live bait to the fishing-ground and to take back alive the fish caught. The live fish taken to the fishing-grounds are not used in connection with the seine; they are liberated on the reef in places where large species of edible fish are known to exist, to attract them from their hiding-places, the fishermen standing by with spears to capture them as they come forth in pursuit of the small fry. This is one of the favorite methods of fishing, not, however, on account of capturing any more fish than with the seine, but for the amount of sport connected with it.

The cars are made of stout withes woven together basket fashion, over a light frame. In shape they are somewhat like a dugout with a very blunt bow and stern. There is more work in one of them than

in an ordinary canoe. An effort was made to purchase one, but the owner could not be persuaded to part with it. Length of car, 9 feet 6 inches; width, 3 feet; depth, 2 feet 6 inches.

Almost every species of fish, including sharks, found on the reef are taken in the stone traps. Most of the small fish are speared; sharks are taken in seines, the seine placed at the mouth of the trap and dragged inside toward the head, which causes the sharks to become entangled in its folds, when they are easily captured. Sharks are taken mostly for their fins and tails; they are sold to traders, who in turn dispose of them to Chinese.



Fish-car, Bora Bora.

The beach in front of the village proved too rough for seine work. Hauls were made in all the available places, including two sloughs; mullet and crabs were the principal species taken. A fish-trap and a crab net set on a reef close to the ship were found empty, and hand lines were also tried unsuccessfully.

THE COOK ISLANDS.

On November 21 we arrived at Aitutaki, an island belonging to the Cook or Hervey group. Having been informed that our time on shore would be limited, the only apparatus taken ashore was a small seine. The beach near the village was found to be very smooth. The seine was hauled six times, and five species of fish were caught.

We learned that nearly all of the fish consumed at the village were taken on the reef and off a number of islets lying to the southward. On the reef surrounding the islets are several stone traps built on the same plan as those in the Paumotu group. The rim of the barrier reef near the village is quite wide, and on it are many pools in which fish are found at low water.

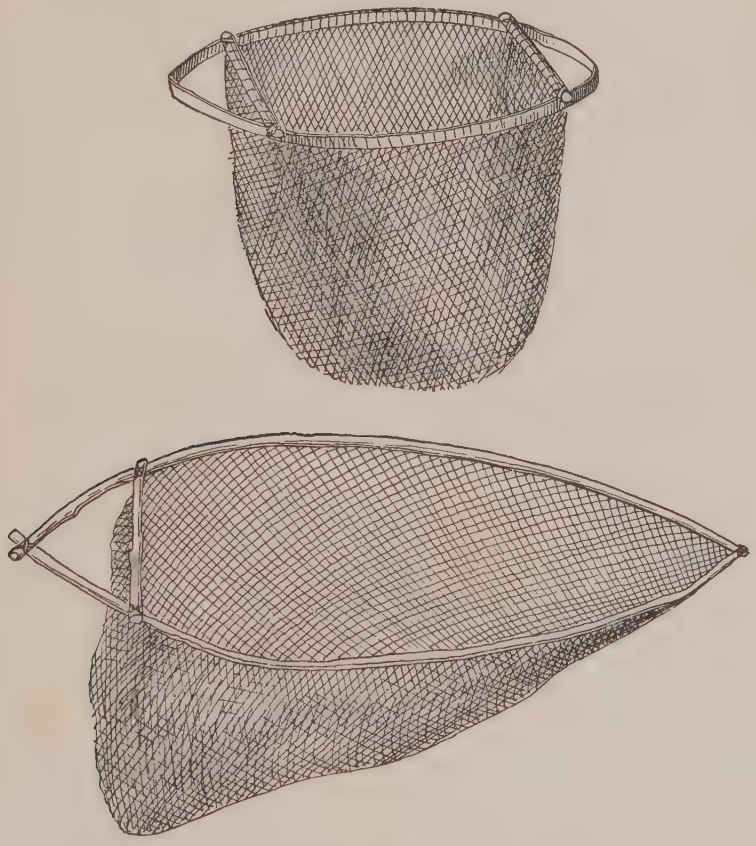
The natives of this island have three ways of taking fish from the traps—with spear, with a basket-shaped dip net, and with a heavy piece of webbing used in the manner of a drag seine, as at Bora Bora. Many of the fish which enter the traps are comparatively large, and the apparatus for capturing them is correspondingly strong.

The bow of the basket-shaped net is 9 feet long and 3 feet wide,

LARGE DIP NET, AITUTAKI.

FISH TRAP, AITUTAKI.

consisting of a withe bent to the desired shape, and a brace on either end which forms a handle. The net is 3 feet deep and made of cocoanut fiber and cotton webbing. As much cotton is now used as native material, it being supplied by traders. It takes two men to handle the net; it is held across the mouth of the trap and the fish are driven toward it from the other end. As fast as fish are caught they are thrown into a canoe.



Large Dip Nets, Aitutaki.

Shark nets are of heavy material, are 40 to 50 feet long, 6 feet deep, and have a mesh from 5 to 6 inches. Occasionally sharks enter the traps. As soon as one comes in contact with the net, it is wrapped up in it, which renders it helpless, and it is then easily dispatched.

Hook-and-line fishing is carried on outside the lagoon, off the reef, the hooks being similar to those described on page 768. This hook was at one time the only style in use in most parts of the South Seas.

The wicker-work fish-traps differ in design from those observed at other islands. They average 2 feet in diameter at the bottom, 1 foot across the top, and 20 inches high. The mouth or lead is at the top

and extends to within 4 inches of the bottom; diameter of lead, 5½ inches. The bait is fastened at the top between the lead and the inner side of the trap. A door opens on the side. In order for a fish to reach the bait it must pass through the funnel out into the trap and then to the top. When once through the funnel it is very difficult for a fish to escape. The traps are set in various depths of water, in the lagoon, on the reef, and outside. Stones are fastened to the bottom to anchor them. Instead of a single buoy at the surface to mark the spot where set, pieces of wood about 7 inches long are attached to the buoy line about 5 or 6 feet apart. A string of these floats, reaching from the surface to the bottom, is attached to each trap. Why one large surface buoy is not used instead of so many small ones we were unable to learn.

The canoes observed on this island do not differ, except in a few minor points, from those of Tahiti and many of the islands in the Paumotu group. At the first glance it was quite evident that the style and finish had undergone a change from the original; they lacked many qualities found in canoes at isolated islands. One canoe measured 13 feet long, 13 inches wide at the gunwale, and 16 inches at the water line. The original shape of the log had been retained amidships, which accounts for the difference in width. Both bow and stern turned up, commencing at the water line and carried out almost to a point. A deck covered the forward part 2½ feet and on the after end 14 inches. There were mast steps both fore and aft; mast partners on the after side of crosspieces. Outrigger 6 feet from the side; outrigger float 12 feet long, 6 inches wide, and 4 inches thick, turned up at each end. Crosspieces of frame 7 feet apart and connected to the float by pins or stanchions, consisting of a tree branch, the butt ends wedged into holes cut in the float and the crosspieces seized to them. No brace of any kind to strengthen frame. As little work as possible seems to have been performed on the canoes of this island, and that in the most careless manner. This arises from the fact that whale boats have been in use here for many years.

NIUE OR SAVAGE ISLAND.

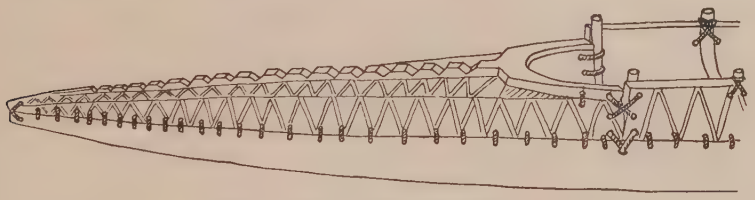
We arrived at this island November 25 and landed at Alofi village on the northwest side. There are ten other villages, two of which are considerably larger than Alofi. The total population of the island is about 4,000. We saw nothing to indicate that any great amount of fishing is carried on. There is no barrier reef to form a lagoon, and the fringing reef on this side of the island being narrow, the opportunities for extensive fishing are limited.

The only fishing apparatus observed was a net 60 feet long, 6 feet deep, with a 2-inch mesh. It could have been used either as a drag seine or gill net, but was probably put to the former use. The floats

were made of koa wood, 3 inches long, 1 inch in diameter, and 10 feet apart. On the foot line were fastened pieces of coral. The head and foot ropes are made of the usual cocoanut fiber, the webbing of some native material unknown to us.

In some respects the Niue canoe is different from any heretofore examined, particularly in ornamental display. It also has a crowning deck 8 feet forward and 7 feet aft. The main body is practically the same as found at many other islands; that is, the bottom is dug from a single log, the top is made of several pieces, and the two parts are joined together with cocoanut-fiber twine; pandanus leaf between the seams, covered with a white pitchy substance. On account of the scarcity of logs of suitable size the bottom is solid and the top is built up of strips.

At the place where we landed there were several canoes hauled high up on the bluff, there being no beach on this part of the island, and as the fringing reef is narrow it affords no protection. The canoes were covered with heavy matting and palm leaves to protect them from the



Sketch of Half Canoe, Savage Island.

sun. Seeing that we were interested in the canoes, the natives gave every opportunity to photograph and take measurements, and were apparently pleased that we were interested in things which they possessed. The large canoe measured 25 feet over all; decked over forward and aft, the deck hewn out of a solid piece, carved on the top and sides; width of canoe, 16 inches at the gunwales and 18 inches where the top and bottom join together; depth, 13 inches; outrigger float, 10 feet long, 5½ feet from the side; outrigger frame, consisting of 3 crosspieces 3 feet apart, fastened to the gunwales with coir sennit and connected to the float by stanchions 12 inches high. In the canoe under each crosspiece was a spreader, consisting of a withe bow bent in, the top or ends about an inch above the gunwales, the bow part raised from the bottom 7 inches. The bottom of the canoe being solid, no strengthening timbers were needed. Hanging to the outside gunwales was a single row of sea shells, all of one species and evenly matched as to size. There was nothing in this and other canoes examined to indicate that sails are used.

The people of this island do not seem to depend so much on fish as those living on atolls. Here the ground is more productive and furnishes food in abundance.

THE TONGA ISLANDS.

EUA.

Our next landing-place was Eua, a small island in the Tonga group, surrounded by a fringing reef and covered with a rich growth of vegetation. The eastern shore is very precipitous, with a number of small caves close to the water's edge, into which the sea rushes with great force. Many "blow holes" were observed in the old coral rock. In a few places small sandy beaches had formed immediately in the rear of the beach rock, but its ragged front would prevent any attempt at collecting with a seine.

The ship lay to off English Roads, and a party landed at Ohonua village, on the western side of the island, a place of about 300 inhabitants. We could find no suitable places on the reef for collecting with a seine. In a small stream on the outskirts of the village 14 mullet were caught in a Baird seine. Numerous snags in the stream prevented even a small seine being used to advantage. We followed up the stream for a half mile without finding any better seining-ground than at the mouth. By clearing out the bed of the stream fairly good results might possibly have been obtained.

While there were no canoes at the village or anywhere in the immediate surroundings, it is unlikely that these people are without them. There may have been a number away on some excursion at a distant part of the island.

Hauled up under cover, near the mouth of the stream, was a square-stern, straight-stem, clinker-built boat, sloop-rigged, 25 feet long and 9 feet wide, decked over and with a standing room or cockpit aft, and a 2 by 3 foot hatch forward leading into the hold. This boat had probably been purchased from some passing trader and used only in visiting neighboring or distant islands. It apparently had not been in the water for a long time.

The entire absence of nets or other apparatus led us to believe that but little fishing is carried on at this island, and as near as we could learn it is all done with spear. In the evening three men, carrying torches of cocoanut husks, were engaged in spearing fish on the reef.

TONGA TABU.

A visit of two days was made to Nukualofa, on the island of Tonga Tabu. Shore collecting was carried on at both stages of the tide. A platform makes off a long distance from the shore, and, like most reefs of its kind, exposed at low water, contains many pools in which are small fish. Compared to many other reefs of a similar character, a scarcity of fish and other animal life was found. At low water a collecting seine was taken to the reef and repeated trials were made in the pools, but with only negative results when used in the ordinary way. By using it in the manner of a trap, as was previously done at

other islands, a few fish were captured. Several species of crabs were taken with a dip net. It was impossible to haul a seine on any part of the reef visited. Spear, trap, and dip net are more useful and are used by the natives.

In front of the town, and for a number of miles on either side, is a long, narrow, sandy beach; this suddenly merges into the reef platform, and it is only when the tide is high that a seine can be hauled on any part of it. One afternoon was spent in fishing with seine along this beach. The principal part of the catch was mullet, and flounders were also taken in a number of hauls.

Hand-lines with various kinds of bait were over the side of the ship most of the time, but not even a bite was felt. A crab net was set and repeatedly hauled without results.

Four wire traps were set on the reef, two near a native trap, and two on the edge of the reef, in about 6 feet of water. They were down 24 hours and were visited three times, but nothing was taken in them.

A trammel net was set in 12 fathoms of water, remaining down 24 hours; no fish were found in it.

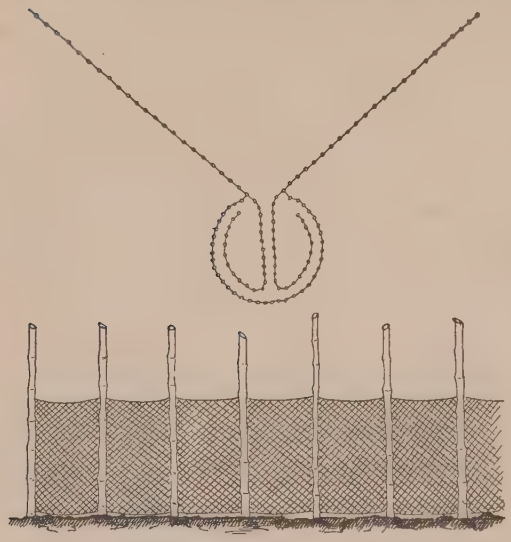
The natives of Nukualofa do not apply themselves very industriously to fishing, but are more given to raising fruit for the Australian and New Zealand markets, there being a line of steamers plying between those countries and Tonga. Since this line was established the natives have given less attention to fishing than formerly. The making of fine canoes and fishing apparatus is looked upon as of minor importance as compared to labor which will bring them a few dollars.

So far as we could learn, no fishermen are regularly engaged, except when the steamer arrives; then men and boys repair to the reef and capture enough for her wants; at other times the women and children do most of the fishing, supplying the immediate wants of the town.

Like most places in the South Seas, fishing here is to a considerable extent carried on in the night. Spearing is the principal method of capture, though hook-and-line fishing is at times performed. We saw none of the latter and very little of the former method. One evening a few men and boys gathered on the reef, the men with spears and the boys carrying torches. When the tide is high a canoe to hold the fish is generally towed along the beach by one or two boys. When the reef is bare, baskets made of palm leaves are carried on the backs of men, women, and boys to deposit the catch in. At high water fishermen confine themselves close to the beach, where mullet generally school in considerable numbers. At other times they travel over the reef, searching in all the pools for fish, jumping from one to another in bare feet over the sharp coral, ever on the alert for the slightest movement in the water. The light of the torches thrown suddenly into the pools or little channels will startle fish that may be at or near the surface, causing them to dart into holes or try to make their escape

through an outlet. It is then that the accuracy of aim is exhibited by the spearman.

On the outer edge of the reef was a native fish-trap, unlike all others noticed, and built of bamboo poles and wire netting. The stakes were 8 feet long and 3 feet apart, driven in the crevices in the coral. The wire was attached to the stakes 3 feet from the top. At high water the top of the wire was just awash; offshore lead, 200 feet; inshore lead, 150 feet. The trap proper was built somewhat in the shape of a heart, 60 feet in diameter. This was the only trap noticed. There may have been others elsewhere of different construction, for the reef covers a large area. Our work kept us within a few miles of the village, and only a small portion of the fishing-ground was explored.



Fish-trap, Nukualofa.

The canoes of Tonga do not materially differ from many of those noticed in the Paumotus. The natives of Tonga Tabu, like the people of many other islands, have been too long associated with civilization not to have lost a great deal of their ability as canoe-builders, and probably never again will the beautifully made canoes be seen among the islands of this group. Boats of every description are fast supplanting the dugout and all other forms of canoes.

One canoe was measured, which will answer as a type: Length, 17 feet; width, 14 inches; depth, 15 inches, dug from one piece of wood. A top rail 4 inches deep and 1 inch thick ran the whole length, and was seized on with the usual cocoanut-fiber thread. The holes through which the seizing passed were 4 inches apart, and on each side of the seam was a bamboo strip; no gum or pitch in the seam. At the water line the canoe was 2 inches wider than at the gunwales; very round on the sides and bottom. Stem straight, stern tapering nearly to a point. There were two thwarts, one forward, the other aft, and both nailed to the gunwales. The crosspieces forming the frame of the outrigger were 6 feet apart, and they were also nailed to the gunwale, the outer ends being fastened to the float by withes wound around pegs. The float of the outrigger was made of koa wood, 10 feet long, 4½ inches in diameter, and 3½ feet from the side.

NAMUKA.

This is a small island belonging to the Tonga group, about 58 miles north of Nukualofa. The *Albatross* arrived here December 2 and anchored 2 miles off the village. No collecting was done on Namuka, but a landing was made on an islet not far from our anchorage, where we found fairly good beaches for hauling a seine. A reef surrounds the islet, and between its inner edge and the shore is a level stretch covered with coral sand. It makes off from the shore quite steep for about 30 feet, then continues level fully 100 feet, terminating in a fringe of old coral, on the outside of which commences a growth of live coral.

Nine hauls were made with the seine along the beach. The result was a few half-beaks, crabs, a small flounder, and a variety of coral fishes. The water was exceptionally clear, which, in all cases, is against successful results. There was a scarcity of life on the reef and in consequence a very small collection was obtained. In a hut were four natives, they having come across from Namuka the evening before to fish on the reef. They had taken one fish, which they were eating at the time we met them. A number of small seines were hanging in the trees in front of the hut; they were machine-knit and require no special mention.

The canoes belonging to the natives were about the same as those we saw at Nukualofa, except that they were decked over forward and aft; the deck was made of tops and sides of boxes.

A wire trap was set on the reef, in which a hermit crab was taken. Hand lines over the ship's side caught nothing.

VAVAU.

A run of 110 miles in a north and easterly direction brought the *Albatross* to Vavau, the last island visited in the Tonga group, where we remained part of two days, anchored off Neiafu.

While Vavau in most parts is rugged and precipitous, with promontories projecting into the sea, yet in the harbor of Neiafu was found the best beach for seining since leaving Nukuhiva, Marquesas Islands. This beach lies about a mile from the village; it makes off to a point and is very smooth, being composed of fine coral, sand, and mud. In all other parts of the harbor within 3 or 4 miles of the village the shore is very steep, and in the few places where small beaches appear they are strewn with masses of broken coral.

It was stated that the natives do but little fishing in the harbor, the water being too deep. At one time dynamite was used in capturing fish. For a number of years its use has been prohibited, since which time fishing has been performed by simple methods.

On the beach above mentioned the seine took 350 fish in number, among which were half-beaks (two species), mullet, and many small fry;

specimens of each kind were saved. Just back of the beach on a high bluff is a small village. As the seine was being hauled the natives came down to the beach to watch the operation. They seemed astonished that we should save fish for which they had no use. They would pick out certain kinds of fish, point to their mouths, shake their heads, as much to say that they were unfit to eat. A fish not fit to eat was, in their estimation, of no value. We were informed by a white man, who had a boat-building establishment at the foot of the bluff and on the upper side of the beach, that the people of this village do but little fishing.

A trammel net was set in 24 fathoms of water not far from the ship and close to the beach. Fish were abundant, but none was taken.

Just back of the village is a lagoon, in which the natives do most of their fishing. Its entrance is cut off from the harbor by a high bluff, around which the distance is about 7 miles. The beach in the lagoon is smooth and makes off from the shore a long distance, and so far as we could see is free from coral. A number of seines were hanging over poles to dry; they were cotton and machine-made. The people were all too busy trading with the ship's company to do any fishing, consequently we saw none of their methods in operation. If one could remain long enough at each island to witness the various occupations of the people many interesting facts could be learned.

A favorite way of fishing is for men, women, and children to turn out in a body, surround a school of fish in canoes, pushing before them long branches of cocoanut palms. The branches frighten the fish and cause them to crowd together; they are then easily driven into shallow water and kept there by continual working of the leaves. Quantities of poisonous berries are then thrown among the fish, which cause them to rise to the surface in a stupefied condition, when they are captured with spear and dip net.

The canoe of this island is practically the same as that of Tonga. It is said that about thirty years ago canoes ranging from 40 to 60 feet were common among the islands, but it is doubtful if there is now one in the entire Tonga group. Large canoes were built of many pieces, the logs being too small to produce one much over 20 feet in length. The cutter, schooner, and small sailboat, introduced about forty years ago, have taken the place of sailing canoes. The canoes of to-day are made with modern tools; those previous to the coming of the white man with native manufactured tools. The fact that a white man can build a cutter and several rowboats in the same time it takes a native to build a dugout has a tendency to discourage the latter from entering into competition, and, moreover, his association with civilization has not made him more energetic than he formerly was.

CANOE, KAMBARA.

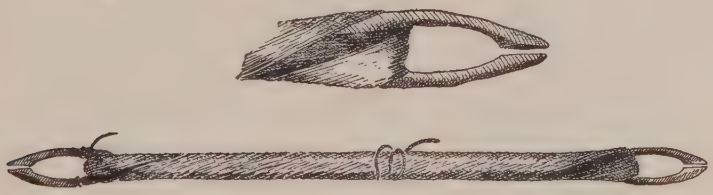
CANOE, SUVA, FIJI.

THE FIJI ISLANDS.

Kambara was the first island landed on in this group. It is small and somewhat isolated, and as a result its people have retained many of their old customs.

Fishing is carried on in the usual manner of natives, whose only object is to supply their immediate wants. Basket fish-traps, hook and line, spears, and seines are used. The reef extends off from the shore but a short distance. At low tide it is mostly bare, leaving the usual pools from which fish are captured with spear. The traps are the same kind as described on page 780. They are set in deep pools on the reef, and when the sea is smooth are placed in deep water on the outside of the reef. Stones are put in the bottom for ballast. We did not see any buoys used for marking the position of the traps.

On the village side of the island, the side on which we landed, the beach is not suitable for collecting with seine; but several attempts were made, meeting with poor success, tearing the net badly. The result was 1 flounder and 5 gar-fish.



Needle, Kambara, Fiji.

While we saw no beaches where seines could be used, yet no doubt there are places where they can be operated, for in walking through the village we came across several seines 40 to 50 feet in length and 6 to 9 feet deep. The mesh was small, averaging 2 inches. The seines were made of fine cotton twine and were hand-knit, with floats of koa wood, and small pieces of coral seized to the foot line. A bamboo mesh board is used, the same pattern as seen in all parts of the United States. The needle is like that used by Italian and other fishermen in the Mediterranean, and is also found in the Tonga group and Society Islands.

At Kambara, for the first time, we saw the double canoe of the South Pacific, but at a great disadvantage, it being hauled up on the beach and covered over with palm leaves. There were also on the beach several single dugout canoes, one of which was measured. It was 31 feet long, 2 feet wide at the gunwales, $2\frac{3}{4}$ feet at the turn of the bilge, and $2\frac{1}{4}$ feet deep; round-sided and quite flat on the bottom; bow quite sharp; straight stem; stern gradually tapering to almost a point. In digging out the canoe, raised portions of wood 2 inches wide and 1 inch deep had been left, forming clamp and bilge strakes. Body of

the canoe three-fourths of an inch thick. Outrigger float, 18 feet long and 15 inches square, turned up at each end and shaped like the bow of a boat. Distance of float from the side of canoe 7½ feet. The framework of the outrigger consisted of 5 crosspieces 3½ feet apart and projecting out by opposite gunwale 12 inches, fastened to pole running parallel with the canoe. The stanchions connecting the outer ends of the frame to the float were 15 inches high, and were made of tree branches cut to form a fork, the butt ends being inserted in the float, the crosspieces seized to the upper ends of the fork. The frame was braced with 4 poles. These canoes have no braces, ribs, or thwarts on the inside, neither do they carry a sail. In every part they are neatly made, much care having been taken to make them smooth.

In every detail the double canoe displayed fine workmanship, showing that the old style of canoe-making, at least on this island, is not lost. It would be quite difficult to describe a double canoe; there are so many parts connected with it and so peculiarly put together that almost any description given will convey little meaning unless accompanied by a series of photographs or sketches. Photographs should be taken from various points of view under sail. At this late date these are hard to obtain, for canoes of this type are seldom seen except in remote regions.

The following measurements may give some idea as to the general features of a Fijian double canoe. One canoe is invariably larger than the other, and the smaller is to the larger what an outrigger is to a single canoe. The larger canoe was 40 feet 9 inches long, 22 inches wide at the gunwales and 27 inches at the bilge. The other measured 37⅓ feet, 20½ inches wide at the gunwales and 23 inches at the turn of the bilge; depth of each 2 feet 5 inches. Each canoe was dug from a single log. They were 7⅓ feet apart, connected by what may be called a platform 16 feet long, 10 feet 10 inches wide, projecting out over the opposite gunwale of each canoe and raised up 12½ inches, the forward and after ends resting on thick pieces of wood neatly fitted in thwartships, which form a double bulkhead. Between the bulkheads on each side a heavy piece of wood was fitted to the gunwale, the whole forming a kind of coaming; similar fittings were on the small canoe.

The platform connecting the canoes was made of stout poles and seized to the coamings 15 inches apart. That part of the platform covering the large canoe was covered with planks 5 inches wide and 3 inches thick, and fastened to the poles by cross seizings of heavy cocoanut sennit. On the platform in the center of the large canoe was a thatched-roof house, one side of which was open. In it was a bunk large enough for two people. The house was 6¾ feet long, 4 feet wide, and on the front side 3 feet high, the roof sloping to the platform in the rear. On each end of the platform near the outside

edge was a hole 8 inches square, in which the steering paddle is placed. Again, on one side of the platform, over the hold of the canoe, was an opening 3 feet long by 18 inches wide, through which water is bailed.

The bow and stern of the main canoe differ considerably, the stern ending somewhat in the shape of a top, big end up, 7 inches deep and 5 inches across; the bow gracefully shaped, sharp and slightly turned up from where the water line begins. On the outside of each canoe, commencing at the break of the platform, 14 inches from the side, on

Small Sailing Canoe, Fiji.

a level with the gunwale and joining at the bow and stern, was a pole rail, and on the platform above a protection rail 8 feet long and 2 feet high. On the top side of the platform was the mast step, carved out of a solid piece of wood, resembling the hub of a carriage wheel; the step was lashed to the heavy planking of the platform. The foot of the mast in these canoes is not placed in the step, but rests against it, first on one side and then on the other, according to which end of the canoe points to the wind. The head of the mast always leans

forward, and as the bow and stern alternate in position when working to windward, it necessitates the shifting of the mast each time the course is changed.

It is well known among seafaring men that the South Sea canoe does not tack in beating to windward in the same manner as a sail boat—that is, first presenting one side to the wind and then the other. With the canoe the same side is always to windward. In running before the wind great care has to be taken not to jibe the sail.

There were no sails or masts to be seen. The double canoe is steered with two paddles. Those that we saw were 13 feet long, the blades a little over 6 feet, made of hard wood, and very heavy.

At the village a double canoe, larger than the one just described, was in process of construction. It was 48 feet long, $2\frac{3}{4}$ feet wide on top, and $3\frac{1}{4}$ feet at the turn of the bilge, and $2\frac{3}{4}$ feet deep. That work had only recently ceased was indicated by the newly made chips lying about. Our appearance off the island had no doubt put a stop to any work that might have been going on at the time of our arrival. The body of the canoe was nearly completed, and heavy pieces of timber for the connecting framework were on the ground ready to be worked

Steering Paddle for Double Canoe, Kambara.

into shape. No tools were in sight, but the marks in the wood led us to believe that an adze and broad-ax had been used. Ridges of wood had been left inside of both of the canoes, representing clamp and bilge strakes. No trees were noticed on the island that at all corresponded with the size of the canoes. It was not learned where the timber came from for building.

SUVA, VITI LEVU ISLAND.

In the harbor of Suva a fairly good collection of fishes was obtained, mostly taken in seines. Three sizes of seines were used, namely, 15, 75, and 150 foot. In the afternoon and the evening of our arrival hand lines were kept over the side and were carefully tended, but with no success. Two wire traps, set close by, captured 2 fish, both of the same species. After dark the surface electric light was put over, which attracted a number of small fry, and several species were taken with a dip net.

The following day and during the time we lay at Suva hand lines of various sizes were employed in different localities with negative results. Wire fish-traps and crab nets were set in a number of places,

the former taking 4 fish (2 species) the latter nothing. A trammel net set in 12 fathoms of water, not far from our anchorage, was down three days; it was "under run" each morning, but failed to catch anything.

No great amount of shore collecting was done in the immediate vicinity of Suva. The seines were operated in a number of places near Suvavu, a small village 1½ miles from Suva, on the north side of the harbor. Hauls were also made at the mouths of Wai Lami and Wai Navasi rivers. These streams converge into one at their mouths, forming a shallow basin. At low water the basin nearly runs dry, except in the middle, where a small channel has been cut through the soft mud and sand by the current. On the banks of the streams and on either side of the basin along the shore it is impossible to haul a seine at high water, owing to the heavy growth of mangrove trees. These not only cover the beach proper, but in many places extend some 30 or 40 yards below the beach line. Fully 100 yards from the shore the bottom is smooth. Beyond this point commences the reef, upon which numerous patches of coral appear, which extend offshore some 1,500 feet and at low tide are just submerged beneath the surface. It was found that the seine could be used to the best advantage at half tide, as it was then free from the coral below and the mangrove trees above.

A short distance to the westward of the above-mentioned streams, and directly in front of Half Cast Village, is a short beach, where several good hauls were made. Altogether 500 fish were caught here and off the mouths of the streams, among which were many mullet. About a dozen species were secured.

Our success was largely due to the condition of the water, which at most times was roily, caused by the seine stirring up the sand and muddy deposit. In places of this kind it is quite an easy matter to catch fish, and an extended stay in this locality would no doubt result in a collection above the average.

The natives of Suva do not seem to be energetic fishermen. During the time the *Albatross* remained in the harbor we saw no fishing going on. On a number of occasions, however, several parties were observed taking fish from a trap. Judging from the number of traps which were located in different parts of the harbor it would seem that fishing with hook and line, spear, or other apparatus is not carried on to any great extent.

Suva is a town of considerable importance, having a line of steamers touching regularly at different islands in the group, and the large steamers employed between Sydney and Melbourne call here at frequent intervals, creating a demand for native labor. It is therefore natural that at times an occupation like fishing should be abandoned for work more profitable.

The formation of the harbor and the many small streams emptying into it, together with the long flat reefs bordering the shore line, makes a desirable place for traps, and the work of tending them is slight as compared to chasing fish with spear and dragging with seine. Thirty-odd traps were counted, scattered along the shore for a distance of about 2 miles. These traps must capture more than enough fish to supply the town and surrounding villages. No regular markets are maintained.

The traps examined were of the same shape as the one described at Nukualofa, except that on the side of the pocket is a smaller one 8 feet in diameter, from which the fish are taken. The traps are made of bamboo poles and palm leaves, the poles driven into the sand and dead coral 4 to 5 feet apart, the average height 6 feet. The palm leaves reach within 6 inches of the top; average diameter of pocket 30 feet; the leads vary in length from 150 to 300 feet.

The cost of a trap of this kind is within the reach of every native who has a shore privilege.

At Vavau we were informed that when we reached Suva we would be apt to see many of the large sailing canoes, but only small paddling canoes, such as are employed about the harbor peddling fruit, fish, etc., were seen.

The large canoe of early days seems to have been supplanted by the English cutter. Those used here average from 40 to 50 feet in length, 10 to 12 feet beam, deep draft, and cost from $400 to $600. They carry a large spread of canvas, mainsail, fore-staysail, jib, and club-topsail. They are easy to handle, sail well, are seaworthy, and carry considerable cargo. The natives living on the large islands of the group were quick to see the superior qualities of the cutter, which for cruising among the islands is as serviceable as the canoe and in many respects superior.

If there be many large canoes in the Fijis they are no doubt confined to the outlying islands like Kambara, where little communication with the main islands is carried on. While the cutter possesses qualities not found in the canoe, yet, on the other hand, there is something about the latter that appeals even to the white man; their barbaric beauty, unique and original design, harmonize so perfectly with the surroundings and people that it is a pity they are passing away. To visit the Fiji Islands without seeing the big sailing canoe, manned by natives in their picturesque dress, is as unromantic as to visit Venice and find the steam launch substituted for gondolas.

The single dugout canoe of Suva does not materially differ in general build from many seen at other islands, except that in the center they are platformed over, the platform being 7 to 10 feet long and 5 to 7 feet wide, projecting out over each side from 12 to 18 inches. The platform is used for stowing things upon, such as fruit, vegetables, fish, etc. On no occasion did we observe anything stowed in the

FISHING TRAP NET, CLOSING IN ON SCHOOL OF FISH WITH SHORT DRAG SEINES, FIJI ISLANDS.

FISH TRAP, MBAU, FIJI ISLANDS.

FIJI CANOE, HUT, AND NATIVE.

bottom. It is evident that this type of canoe is not used much outside of the harbor; but it is well adapted to carrying light freight from point to point along the shore and peddling among the vessels in the harbor. There are no particular points of good workmanship in these canoes; nails, wire, bits of string, and rope are freely used in fastening the outrigger frame together. Some canoes have three and others four crosspieces to the outrigger frame; the majority have four.

At Suvavu several canoes were hauled up on the beach. The largest was 30 feet long, 14 inches wide, and 14 inches deep, and straight-sided; the bow and stern the same shape—very sharp, straight on the bottom fore and aft, turning up quickly at either end. Some were made of two pieces; this one was made from one piece. The bow and stern were decked over, and in the middle portion was a kind of a washboard, 10 feet long and 4 inches high, which joins to the deck. The platform and outrigger frame were attached to the washboard. The platform was 8½ feet long by 3½ feet wide; there was an open space on one end for bailing out the canoe. The platform and washboard were made of boards which evidently had been picked up on the beach. The outrigger float was 12 feet long, pointed on the ends; distance from the side of the canoe 7 feet. Stanchions connecting float to the outrigger frame were made of withes 12 inches high and four attached to each crosspiece.

The natives of Suva do not propel their canoes in the same manner that most natives do. Instead of sitting or squatting down, using the paddle at the side, these people stand up and scull. The paddle is placed in one of the holes of the framework at the side of the canoe and the sculling is performed in a manner directly opposite to the way a white man sculls. The Fijian style is to face toward the bow with handle of the paddle in front of him, it resting against the after side of the crosspiece. The result is the same as in the ordinary way of sculling except that there seems to be less power exhibited. The paddle is kept perpendicular in the water, which gives it less leverage than if held at a slant. Two or three men can scull at the same time.

We saw no canoes fitted with masts and sails, but were informed that small sail canoes are frequently seen in the harbor.

Natives living in the interior of the island bring their products to market down river in what may be termed freight rafts, made of bamboo poles lashed together in the shape of a double canoe. Each bunch of poles is about 40 feet long and 4 to 5 feet in diameter in the center, tapering at the ends. The bunches are placed side by side a few feet apart, and connected by a bridge of the same material; on this bridge is a platform housed over in a manner somewhat similar to a native hut on shore, top and sides thatched. Under this cover are the living quarters. This style of canoe is frequently seen at the wharves at Suva.

THE ELLICE ISLANDS.

Leaving the Fiji Islands the *Albatross* proceeded to Funafuti, an atoll in the Ellice group, arriving off the pass at Funafuti on the morning of December 23, and anchoring later in the day off Fongafale village, about 8 miles from the mouth of the pass. The village and general surroundings of the atoll resemble that of Fakarava in the Paumotus. In front of the village is a long beach where seines were dragged each day. In all the trials about 1,400 fish were caught, among which were some 16 or 18 species. The beach is smooth for about 100 feet below high-water mark; from this point, for 200 feet or more, the bottom is very rough, being covered with a growth of live coral; from here on into comparatively deep water the bottom presents a smooth, sandy appearance. Where the fish were most plentiful it was found impossible to haul the seine. We found this to be the case at most places in the South Seas.

Only 2 fish were caught with hand lines from the ship. A crab net and several wire fish-traps were baited and set on the reef until the morning of our departure. Each time they were visited many fish were seen around them, but nothing was taken.

On Christmas an excursion was made to an island 6 miles from the village, four natives accompanying the party as pilots. Several long trials were made with hand lines on favorite "spots" known to the natives. The catch amounted to 11 fish, 4 species, all of which were saved. The native fishermen used the same kind of fishing gear that we did. Instead of baiting the hooks in the usual manner, they seized it to the shank, in the manner of the Alaskan Indians.

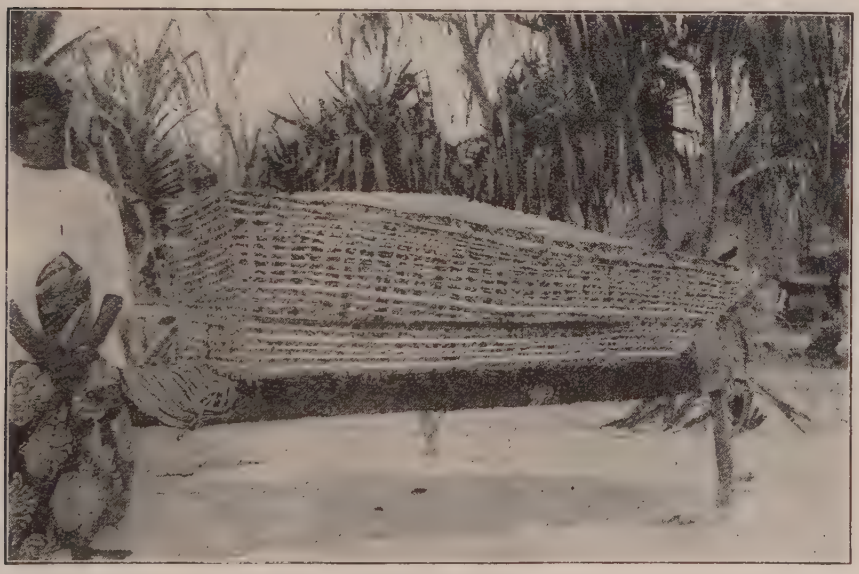
By the aid of the electric surface light displayed over the ship's side a number of small fishes were taken.

Small drag seines are used, knit of cotton twine, like those observed at Kambara. The manufacture of small seines from native material seems to have been wholly abandoned, it being easier to procure net twine from passing vessels than to make the original article from cocoanut husks and pandanus leaves. Large seines, made of coarse, heavy material (cocoanut-fiber twine), are used in capturing turtle. These seines vary in length from 60 to 100 feet; depth, 9 to 12 feet; mesh, $5\frac{1}{2}$ inches. Turtle in this region are not numerous, but appear periodically and are a delicacy much sought after.

In hand-line fishing common steel hooks are generally used, but when they are not to be had the native hook is resorted to. American and English hooks are much preferred. Hooks and lines were given to the men who accompanied us on the fishing excursion, and they seemed to greatly appreciate the gift. There being no trader on the island, hooks, lines, and useful articles are not always easy to obtain. Steamers and small trading vessels sometimes call here, supplying the people with such articles as they may need.

The spear is used in capturing fish on the reefs. Its pole is 8 to 10 feet long, to which is fastened a single iron prong with a barb at the extreme end. Wooden spears have long since been discarded.

Wickerwork fish-traps are set on the reef near the village and on distant fishing-grounds among the islands forming the atoll. These traps are made in a sort of network fashion, the openings 2¼ inches long by three-fourths inch wide. Size of trap, 60 inches long on top by 50 inches on bottom; front end slanting considerably, back end slightly. Front end 38 inches wide and 12 inches deep; depth measured on the slant. Rear end 35 inches wide and 19 inches deep. Mouth of funnel or lead 11½ inches across by 8½ inches deep, carrying its size inside for about a foot, then gradually tapering, ending almost in a point. As the open-



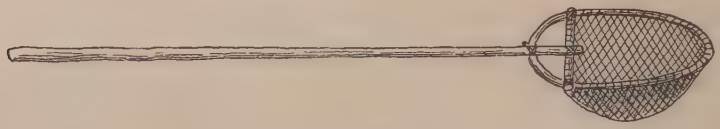
Fish-trap, Funafuti.

ing is at the extreme end and on the underneath side, there is very little chance of a fish making its escape when once in the trap. A pole runs lengthwise through the top part of the trap, from which the inner end of the lead is suspended. In the rear end is the door from which the fish are taken. Traps are baited with fish hung near the end of the lead, the bait being plainly seen from the outside. They are set in depths of 5 to 20 fathoms, and at distances from the village varying from 2 to 10 miles. They are not lifted for several days.

Coral reefs and shoals are numerous off the islands in the lagoon and on the rim of the atoll; to these the natives repair for hand-line fishing. Flying-fish, in their season, appear in considerable numbers; also gar-fish and bonito. Unfortunately we saw no fishing by the natives, except as previously mentioned. Torching for flying-fish is one of the favorite sports. The fish are attracted to the canoes by the

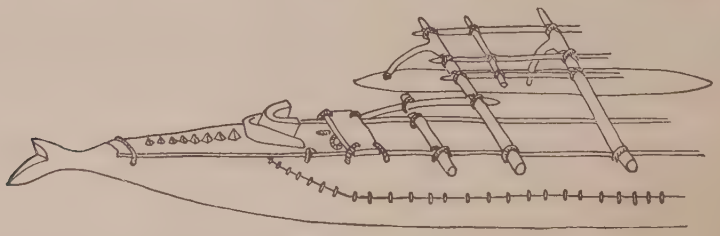
light, and scooped up in long-handled dip nets. The nets are oblong in shape, nearly the same pattern as those observed at Tahiti.

The dugout prevails in the Ellice Group, and is unchanged in most respects from many which have been described, but in ornamentation and small details a considerable difference is noticed. This canoe is 27 feet long, 17 inches wide, and 21 inches deep, with a kind of deck forward and aft 45 inches long. Each deck is made from a single piece of wood, and on the after one the top is serrated, supposably to represent the teeth of a sperm whale. The stern is formed like the tail of a fish. The bow is free from embellishment of any kind.



Scoop Net, Funafuti.

Just forward of the row of notches the deck is raised at an angle of 6 inches, forming a sort of break 1½ inches high. On top of the break is carved a ball, with a groove in the upper part. In the groove the fishing pole is placed, the butt thrust into a becket attached to the under side of the thwart. This is the only thwart in the canoe and is used chiefly by the person engaged in fishing. There are three braces, however, which may be used to sit on when paddling. The canoe is straight-sided, also quite straight on the bottom, with an easy turn at the bow and stern. Three crosspieces connect with outrigger float; the float is 11¾ feet long and 5½ inches in diameter. The crosspieces and



Sketch showing Stern of Funafuti Canoe.

stanchions are formed out of one piece. Heretofore, in all the canoes examined, the float was attached to the outrigger frame directly under the ends of the crosspieces; in this one the stanchions project outboard at an angle, and are fastened to the float by means of pegs and sennit. Flat, narrow strips of cocoanut wood run parallel to the gunwale and are fastened to top side of the crosspieces, on which are carried spears, fishing poles, paddles, etc.

The style of paddle does not need description. The bailer is shaped like a common flour scoop. None of the canoes was rigged for sailing.

CANOE FUNAFUT.

SAILING CANOE, RONGELAB. (See page 806.)

THE GILBERT ISLANDS.

While coasting off the south shore of Arorai Island, we saw a large gathering of people on the edge of the reef fishing with hook and line. The lines were attached to long poles. Stormy weather prevailed and the sea was breaking against and sweeping in over the reef. We were of the opinion that the condition of the weather and roughness of the sea were the means of bringing in fish that do not approach the reef in milder weather. We learned that this was the case among many of the islands. The ship lay too far offshore to see the size of fish which were caught.

In the course of half an hour a canoe was launched through the breakers and came off to the ship; shortly after another one came off. Each made several attempts before succeeding in getting clear of the reef.

The canoes were entirely different from any of those we had seen. We had suddenly left the region of the dugout and entered that of the built-up canoe. In shape they somewhat resembled the sea-otter boat of Alaska. Their estimated length was 22 feet; width, 4 feet; depth, 20 inches; material cocoanut wood. Each had 7 sets of timbers; keel about 5 inches wide, planking 4 to 6 inches wide without butts, that is, each plank running unbroken from stem to stern and fastened to the stem and stern posts with cocoanut fiber thread. The edges of the planks were fastened together in the same manner.

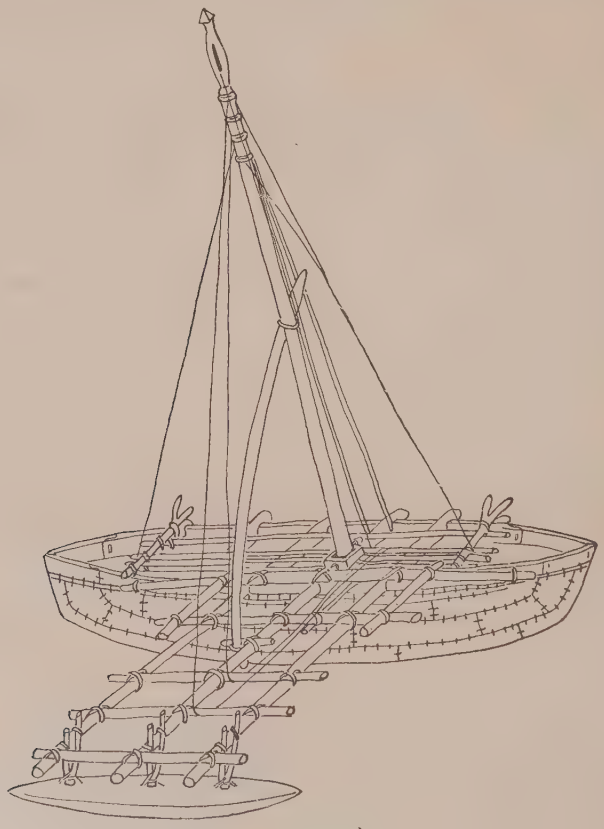
Instead of the seams being covered with bamboo strips, they had a thick coating of gum on both sides. The stem and stern post were neatly scarfed to the keel. No metal could be observed in their construction. A few days later we had a better opportunity of examining canoes of similar build.

APAMAMA ISLAND.

On January 1 we arrived off the northeastern side of Apamama. The shore on this side is somewhat protected by a barrier reef. At the time a heavy surf was breaking over it. A number of small bays and indentations fringe the upper beach, a few almost cutting through the rim of the atoll into the lagoon. On a small isthmus formed by one of these cuts is a village; in front of it is a sea wall built of blocks of coral rock. On the lagoon side of the island, about a third of a mile from where we landed, is another village. There were only old people and children at home, the rest of the inhabitants having gone on a visit to a distant island in the lagoon. Each house seemed to have a water privilege, and all along the beach were net-drying racks.

The canoes of Apamama are built in the manner of a boat. A frame is gotten out and put together in the usual way. The timbers are round, consisting of heavy withes bent to the desired shape.

The length of the average canoe is 15½ feet; width, 20 inches; depth, 2 feet; very sharp on the bottom, the sides rising almost V-shape; bow and stern are alike. Outrigger 7½ feet from the side; outrigger-float 8 feet long, 7 inches wide, turned up and pointed at each end. The framework of the outrigger consists of three crosspieces of cocoanut wood. Seized to the crosspieces at right angles are four braces at nearly equal distances apart. Under the crosspieces, near the gunwale, is a brace three-fourths of an inch in diameter, extending fore and aft

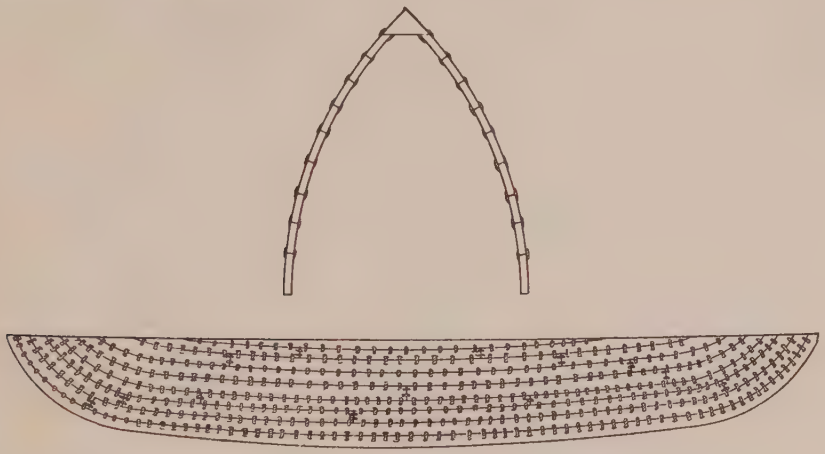


Canoe, Apamama and Tarawa.

to within 3 feet of the bow and about the same distance from the stern, the ends fastened to the gunwale and the middle portion to the crosspieces. On the frame of the outrigger, between the gunwales, are several strips seized lengthwise. These act as an additional brace and also take the place of thwarts. The stanchions connecting the ends of outrigger frame to the float consist of forks of tree branches, the single part fitted into holes in the float. On the outer end of the outrigger is temporarily fitted a notched stick in which the fishing pole is placed. This is quite necessary, as the poles are 12 to 15 feet long and heavy.

When hand lines are used, either in trolling or for bottom fish, they are hauled over the forks of the outside braces. The sketch shows these and also the arrangement of frame, braces, and other parts referred to.

It will be noticed that the mast is not stepped in the bottom of the canoe, but on top of the middle crosspiece of outrigger frame. The step consists of a thick piece of board, 3 by 4 inches, hollowed out in the center in which the foot of the mast is placed. In the bow and stern there is another step, half the size of the former, against which the tack end of the boom is placed. We could not learn whether cotton or mat sails are used. In addition to the shrouds and stays which keep the mast in place there is a heavy wooden support, the lower end fastened out-board to the middle crosspiece, the upper end halfway up the mast.



Sketch of Canoe showing Style of Planking, Apamama.

This canoe is planked in a peculiar manner. Instead of the ends of the planking being fitted to the stem and stern post, as is ordinarily the case, the garboard strake continued along the keel and up the stem and stern. The second strake follows in the same way, and so on, each succeeding row of planking being shorter than the one preceding it.

The canoe proper does not compare in strength with the outrigger frame, mast, braces, etc. The plank is only one-half inch thick, and is considerably weakened by the numerous holes in the edge, through

Apamama Canoe Paddle.

which the seizings are put in binding the plank together. A canoe of this build is not equal to the dugout for landing through the surf on a rough beach. This was clearly illustrated by the number of broken

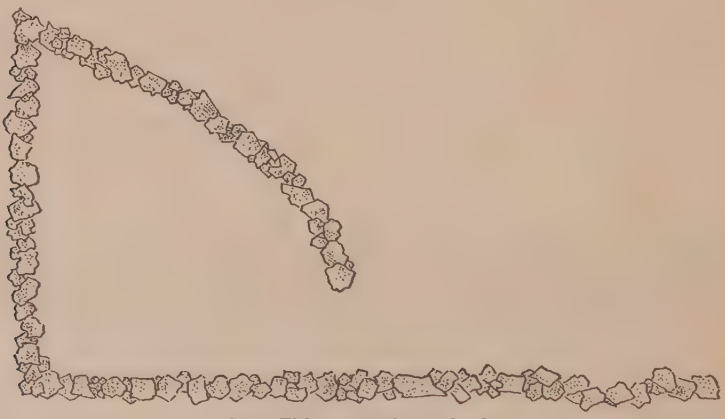
canoes lying on the beach and triced up in trees. When a canoe is damaged so that it can not be repaired, the pieces are saved and used in building a new one.

The paddle resembles a spoon oar. The bailer is made of one piece of wood, and is very narrow to fit the bottom of the canoe; handle on the outside like a dory scoop.

MAIANA ISLAND.

After leaving Apamama the ship skirted the eastern shore of Maiana Island. From our view the beach inside the fringing reef appeared to be steep. A few huts could be seen, half concealed by cocoanut palms, and some of the natives were along the beach fishing with rod and line.

Several stone fish-traps were observed. They seemed to be more substantially built than those in the Paumotus, evidently to withstand the heavy sea which at times must sweep over the reef.



Stone Fish-trap, Maiana Island.

TARAWA OR KNOX ISLAND.

In the evening of the same day (January 2) the ship lay off the south side of Tarawa. Quite a quantity of surface life was attracted around the ship by the electric light.

The reef on this side of the island makes offshore a considerable distance. Late in the evening many lights were seen moving on the reef, about 2 miles distant, indicating that natives were fishing. On leaving the island the following morning a number of stone fish-traps were noticed on the reef near where the lights had been seen the night before. In shape these traps resemble a palm-leaf fan. We judged them to be about 4 feet high and fully 3 feet thick; the lead was estimated to be 75 or 80 feet, and the diameter of trap about 50 feet. The shape of these traps differs greatly from those observed at Maiana Island, only a few miles distant. The same style of canoe, however, is found at both islands.

APAIANG AND MARAKI ISLANDS.

In the evening of January 3 the *Albatross* lay to off the southern shore of Apaiang. The surface light attracted numerous forms of minute life. The next morning, as the ship steamed on her way northward, we saw at a distance what looked like a double canoe. Later in the day we reached Maraki Island and steamed along its south and east side. We did not land, but had a good opportunity of viewing the shore line and fringing reef. On the reef were many pools and small channels leading from one to the other.

Near the outer edge of the reef are outcroppings of old coral, in many places forming barricades between the pools. Some of the walls thrown up formed natural fish-traps, in some of which men, women, and children were fishing. In a dozen or more places along the beach,

Stone Fish-trap, Tarawa Island.

wood and cocoanut husks were piled up, presumably for lighting at night to attract fish to the beach. Scattered over the reef was a considerable number of fish-traps similar to those seen at Tarawa.

In the afternoon a party landed on the west side of Maraki. The upper beach on this side of the island is sandy, but immediately below are many bowlders of old coral rock, making it difficult to land, unless the sea is smooth.

There is no great difference in the canoes of this island from those of Apamama and Tarawa except that the bottom of the canoe here is dug out of a solid piece of cocoanut wood and is round. The planking is the same kind and thickness as the Apamama canoe and put on in a similar manner, only there is a less number of strakes.

TARI-TARI.

This island was approached from the east side. On the south and east side the rim of the atoll is cut through in several places, forming small islets. The channels between the islets are bare at low water,

but at high tide in stormy weather the sea must pour into the lagoon with great force. Outside the channels is a fringing reef platform on which are many pools. We subsequently learned that this reef is one of the favorite fishing-places on this side of the atoll.

The ship came to anchor in the lagoon off Butaritari, a village of considerable importance in this region. In the evening collecting was performed by the aid of the electric surface light. Besides a large quantity of crustacea we captured a considerable number of vertebrates. Two bonitos were caught on hook and line.

The following day a seaman of the *Albatross* accompanied Mr. Palmer, a merchant of the village, and several natives to one of the outer reefs to fish with dynamite. It is unlawful for a native to use explosives in taking fish unless in company with a white man. The seaman brought back between 40 or 50 small fish and 11 larger ones, varying from 6 to 12 inches in length. Twelve varieties were taken, and samples of each were placed in alcohol. Hand-line fishing and the use of wire traps and crab nets proved a failure.

The people of this group have always been credited with being the best fishermen and using the greatest variety of fishing apparatus of any natives in the South Seas. We unfortunately found but little fishing gear of any kind. Two wickerwork fish-traps, nearly the same pattern as those seen at Funafuti, were purchased.

We were informed that the scarcity of native fishing apparatus among these people is due largely to traders, there being many stationed in various parts of the atoll, who discourage native manufacture and lead the people to either forget how or not care to make any article which may be substituted at the store by something inferior in quality but sold for a high price.

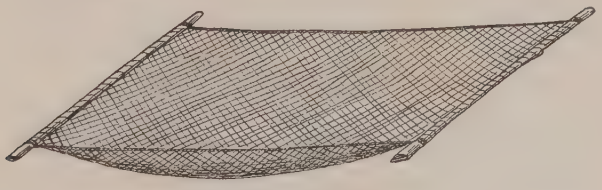
The canoes of Tari-Tari differ in some respects from those of Apamama and Tarawa. They are more nearly like the canoe of Maraki; that is, the bottom is one solid piece of wood, and the sides and top are planked. Two canoes were being built in the village, a departure from the original type, flat on the bottom and made of 1½-inch boards. The first strake was also boarded and flaring outward like a dory. This type is comparatively new in canoe-making and was probably introduced by the traders. Above the garboard strake the planking is put on in the manner of the Apamama canoe. A canoe of this kind is much better adapted to landing on a rough beach or reef than one with a fragile bottom.

In a village a few miles from Butaritari were a number of canoes that had been given a coat of coal tar.

THE MARSHALL ISLANDS.

We arrived off the southeast coast of Jaluit Island January 9. This part of the island is low, with but a scant growth of cocoanut palms; pandanus trees and a thick growth of underbrush reach as far as the beach. The ship entered the lagoon through the southeast pass and anchored off Jaluit, situated on Jaluit Atoll.

All the beaches on this part of the atoll are very rough and make off with a gradual descent. Seines over 15 or 20 feet in length can not be hauled on them. In front of the village is an accumulation of sand, but in most places north and south, immediately below high-water mark, the shore is covered with sharp coral and coral slabs. The reef is about 600 feet wide. Outside the lagoon, opposite the village and for a couple of miles south, the reef is narrower. Above the reef the beach is high, composed of a banked-up mass of broken coral rock thrown up by the sea. Lower down, some 30 feet from the line of



Hand Net, Jaluit.

String of Cocoanut Leaves used with Hand Net.

vegetation, the reef platform commences and makes off quite level. This reef is the principal fishing-ground in the vicinity of the village. Most of the fish consumed by these people are taken on reefs situated some 8 miles north of the pass. We were informed that there is a prolific ground at a small islet in the lagoon 4½ miles from the village. During our stay here the people went on no fishing excursions.

Hand lines from over the ship's side took 7 fish in number, 5 species. On a submerged reef near the ship the wire fish-traps caught 5 fish, 3 species. The crab net and hand lines had no success. Fish were plentiful about the ship, but could not be induced to take the hook. A trammel net set 24 hours in 12 fathoms of water had in it 2 sharks and a small coral-fish. One end of the net caught on the bottom and was badly torn.

Several trials were made with a collecting seine on a beach adjacent to the village; altogether a half bushel of small fry was taken. In a pool on the reef about a mile farther south 19 species were captured by barricading the pool. No attempt was made to haul the seine.

Fish are chiefly taken by spear, net, and trap. The net is neither a drag seine nor a gill net. Attached to poles, a piece of cotton webbing, 8 by 4 feet, is used as a barricade and scoop, in conjunction with a string of cocoanut leaves. Four men repair to the reef, two carrying the net and the other two the string of leaves. The leaves are about a foot long, split into shreds, one end fastened to a sennit rope about 60 feet long. In the water the leaves swing back and forth like seaweed attached to a rock. A school or a number of fish being seen, the men carrying the string separate and endeavor to get between the fish and the outer edge of the reef. This being accomplished, they draw together and at the same time approach the men holding the net, dropping the fringe-work of leaves behind them. The object is to drive the fish toward the men with the net, they frequently shifting their position according to the way the fish move, either to the right or left. Fish once inclosed in the circle of leaves will not attempt to pass under

Fish-trap, Jaluit.

it. The circle is gradually made smaller and smaller by drawing the string together. At last the fish are forced over the net and lifted up in it, taken out and placed in baskets. Repeated hauls are made, and frequently a distance of 2 or 3 miles is covered in a single tide.

The original spear of bone has given way to one of iron.

Another simple device for catching fish is with a braided rope of cocoanut leaves 10 to 12 feet long. These ropes are operated at high water on the beach in the lagoon near the village, men, women, and children taking part. In the evening, when the tide serves right, a dozen or more people may be seen sitting on the beach attentively watching for signs of fish to appear. Not until the school is within a few feet of the beach is any attempt made to secure it, at which time the natives rush into the water, surround the school, and frighten it to the beach by pushing the leaves through the water. In this way the fish are crowded to the shore and thrown on the beach with dip-nets, several people being stationed at the water's edge for that purpose.

MARSHALL ISLAND CANOE ON BEACH.

MARSHALL ISLAND CANOE UNDER SAIL.

Fish are daily caught in this manner; it would seem easy for them to make their escape, but such is not the case.

Fishing with wickerwork fish-traps is quite extensively carried on. The traps are made of pliable withes and put together with cocoanut thread. They vary little in size and none in shape. The average size is 31 inches long, 30 inches wide, and 20 inches deep; the front end is concaved 5½ inches; door in rear 5½ by 7 inches; the mouth of the lead is 9 inches in diameter, 2½ feet long, and shaped like a powderhorn, the concave side next to the bottom of the trap. About a foot of the lead

Sailing Canoe, Jaluit, Marshall Islands.

on the underneath side is open. Traps are set in deep places on the edge of the reef and in channels. There are few places in the lagoon, any considerable distance from the shore, the fish from which are considered fit to eat. We were told by our native pilot that poisonous fish were plentiful in all parts of the lagoon and that no fish should be eaten before being examined by some of the people on shore.

At Jaluit we found a sailing and paddling canoe of an entirely new style, and made principally of bread-fruit wood. They are constructed more on the order of a vessel than any previously examined. The planking is heavy, varying in thickness from 2 to 3 inches. The largest

tree on the island would be too small to make a dugout shaped like these. The largest canoe now found in the Marshall Islands is said to be much smaller than many of those built before the advent of the white man, when canoes 60 and 70 feet long are said to have been common, and long distances were traveled in them, many families taking passage. Canoes of such size have long since been supplanted by schooners ranging from 20 to 40 tons. The schooners are for the most part owned by the chiefs and kings, as the common people are not able to accumulate in a lifetime a sufficient amount of money to purchase one.

Land tenure, or feudal system, still prevails among these people. It was reported that several kings have a yearly income of $5,000, all derived from copra.

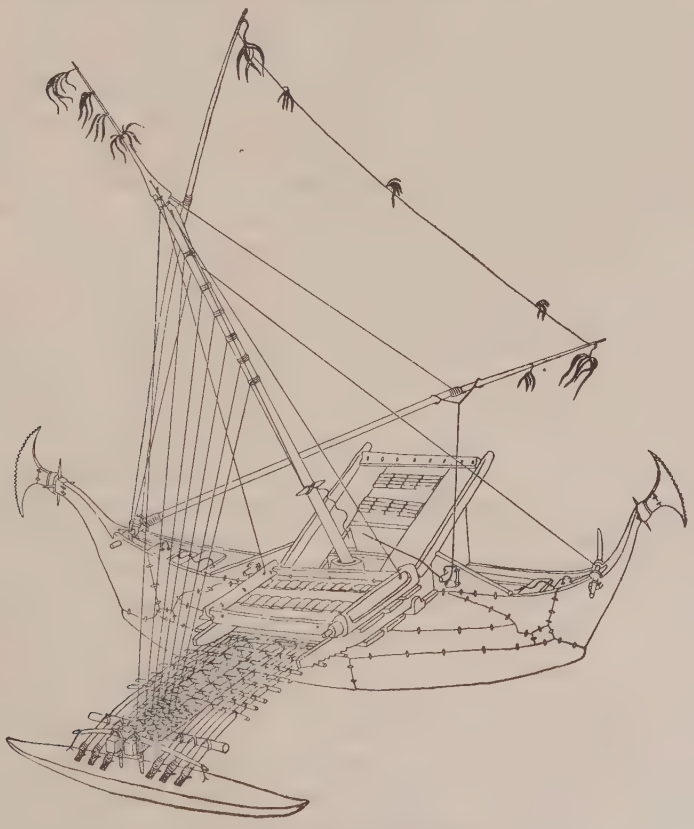
In several of the islands native boat and vessel builders are doing good work, their skill in canoe-building being of material aid in constructing a vessel. Many of the schooners are built in San Francisco.

At the village were four large sailing canoes and fully a dozen small ones. We seldom saw a small canoe in the water, and only on two occasions were the large ones afloat, and one of these times it was at our request. Although these people have long been associated with white men, the shape, build, and rig of the primitive canoe have been retained to a remarkable degree, more than at most places where civilizing influences have existed for the same length of time.

The Marshall Island canoe is too complicated in its construction to attempt a full description of all its parts; the sketch here given will be more comprehensive than a written description. It may be well, however, to give a brief account of the manner in which they are put together. Heretofore the canoes that have come under our notice have been more or less symmetrical—that is, both sides alike, but in this canoe we find one side larger than the other, the outrigger side being more rounding and fuller than the lee side. To illustrate, if a line be drawn from the center of stem and stern, it will be found that there is a difference of several inches between the two sides, the outrigger side always the larger. Whether the canoe be large or small, it is built in this peculiar manner. The object in building the lee side with so much more dead-rise than the weather side is on account of its presenting a flat and nearly perpendicular surface to the water, which acts in the same manner as a centerboard.

The sailing canoes were all about one size, not varying over a foot in length and a few inches in width. The dimensions of the one we measured were as follows: Length, 20¾ feet over all, and 17¾ feet on the water-line; width, 30 inches; depth, 31½ inches; draught, 27 inches, greatest in the center, rocker keel. The outrigger float was of hard wood, 17½ feet long, 10¾ inches wide, and 9 inches thick, and round on the bottom. If a section of the float should be cut off, it would represent an inverted top. The float is well proportioned, very straight

on the bottom lengthwise, and slightly turned up at each end. Length of outrigger frame, 11¼ feet; width, 46 inches, composed of eight pieces, two centerpieces, 3 inches square, forming a kind of backbone. The side pieces fasten directly to the float, forming a slight curve at the ends. The center frames project out from the side on a level. The bend in the side pieces is formed by a cross piece thrust under the center frames, and the side pieces seized to it. On top of the middle frames, near the outer ends, is a strong withe nearly 5 feet long, with



Sketch of Marshall Island Canoe.

the ends drawn down and fastened with sennit to the top of the float. The holes in the top of the float are mortised out from each side, leaving over the holes solid wood 3 inches long by 2 inches deep, around which the sennit is passed in seizing the ends of the cross pieces to the float. Near the outer end of the center frame are seven short pieces, to which the shrouds are fastened. Arranged inside of these, extending all the way across the frame, are eight other pieces, which give considerable support to the structure and are used for fastening things upon.

Commencing at the weather side of the mast and projecting out by the gunwale 2½ feet, and securely fastened to gunwale and outrigger frame, is a raised platform, used for seats and also for stowing articles on. In a moderate breeze the occupants of the canoe, except the man steering and the one who tends the sail, seat themselves on the platform; as the wind increases in force they move farther out on the outrigger frame, acting as shifting ballast. On the lee side is another platform, larger than the first, used for the same purpose, care being taken, however, to have the weights evenly distributed. Both of the platforms are made of hard wood, the sides and ends carved, with an attempt at ornamental display. The lee platform is built out at an angle, resting on a double bulkhead. On the gunwale between the bulkheads is a heavy piece of plank, to which the middle part of the platform is fastened. The whole structure is very strongly built and, like all other parts of the canoe, the platforms are seized together with the usual cocoanut-fiber line. The two bulkheads answer a double purpose, namely, a foundation and support to the lee platform, and a substitute for timbers. There are two permanent thwarts in one end and one in the other; these being large and heavy, they also take the place of timbers. Both fore and aft is a heavy breast-hook. The bow, cutwater, and headpiece, which also includes the stern, is gotten out of one piece of timber, the breast-hook being a part of it. The planking is seized together in the usual manner of all South Sea Island canoes, with pandanus leaves and a white pitch between the seams.

The planks are not of uniform size, short pieces being fitted in between the large ones, as if there were no more to be had. In many cases this is no doubt true. It being difficult to obtain wood of sufficient length, short pieces are utilized, this being a necessity rather than a style. The bottom is protected by a false keel. When not in use, these canoes are always hauled out on the beach.

The mast is stepped between the platforms on a level with the gunwale, not stationary, but in a groove. As the mast is stayed forward each time the course is changed when beating to windward, it is necessary that the foot of the mast be free to work in the step. The gunwales are fitted somewhat like the deck of a vessel, with a waterway 4½ inches wide, and above what may be called a rail, 2⅜ inches high, all cut from one piece of wood. Considerable cargo can be carried in the hold, but it must consist of material that will not be injured by getting wet, for in a choppy sea considerable water is taken aboard.

The sail is made of strips of matting sewed together, in shape very much like the sail of the Italian fishing felucca of San Francisco and the Mediterranean, except that it has a boom. The mast is 23 feet long and 3½ inches in diameter at the step, carrying its size all the way up. The masthead and topmast is made of one piece, of much harder wood than the mast, scarfed on and neatly seized. There are no blocks.

The halyards are rove through holes in the head of the mast. The wood being very hard, the holes become very smooth. The gaff is 24 feet long and 2¾ inches in diameter in the middle, tapering to 2 inches at the ends; boom the same length as the gaff, but heavier. It is oval-shaped, the sail bent to the narrow edge.

The mast is supported by seven shrouds, all on the weather or outrigger side, one leading from the masthead and the others arranged equal distances apart below it and fastened to the outrigger frame. Besides the shrouds are two masthead stays made fast to pins at the bow and stern. The pins are also used for fastening the tack of the sail. The stays are temporarily made fast, one being slacked up and the other hauled taut each time a tack is made. This admits of the masthead being hauled forward. The halliards, a single part, is made fast to a cleat 2½ feet above the foot of the mast. The sheet is also a single part made fast to a bridle on the boom, and the hauling part to a cleat on the weather side of the gunwale just abaft the platform. We were told that cotton sails have been tried, but were too heavy and hold too much wind. The mat sails are lighter and more porous, allowing a portion of the wind to pass through them. This is very essential, particularly when a strong breeze is blowing accompanied by occasional squalls. At such times the sail has to be handled quickly, and as there are no reef points or any means of reefing the sail in the ordinary way, it is triced up by means of a spiller. This brings the weight of the boom and sail near the masthead, and in the case of a cotton sail being used it would make the canoe top-heavy. The spiller consists of a line made fast to the boom in the center of the sheet bridle, passing up the lee side of the sail through a hole in the masthead a little above where the halliards reeve; thence to the forward side of the weather platform, where it is made fast. There are two of these spillers, but only one is used at a time. The second one is on the opposite side of the sail, also rove through the masthead and the end fastened to the other side of the weather platform. By this means there is always a spiller on the lee side of the sail ready for use.

Ordinarily three men are required to sail a canoe—one to steer, one to tend the tack of the sail, and the other stationed at the spilling line. When a squall strikes or a sudden gust of wind comes up, the boom is lifted by pulling on the spiller. This immediately decreases the sail area as much or as little as may be desired, regulated according to the strength of the wind. The force of the wind having passed, the spilling line is slacked away and the boom and sail drop dropped down. If the breeze be steady, but too strong to carry all sail, the boom is hauled up, reducing the sail to the required area that can be carried.

When running free, or with the wind abeam, there is little difficulty in handling a canoe of this rig. In beating to windward, however, more or less complications are likely to arise, such as getting the sail

aback or the boom getting adrift, either of which might cause considerable disaster in a stiff breeze. Should the sail get aback in a strong wind, the mast would go over the weather side, there being no shrouds or stays on the lee side to prevent it.

As previously stated, an outrigger canoe in beating to windward does not come in stays and go about on the other tack, and it may be interesting to some to know how windward work is performed with the wind always blowing against the same side. This is done by the bow and stern changing places, as it were, in such a manner to permit first one end and then the other to point to windward. When a tack is to be made, or we might say a hitch made to windward, the sheet is eased off and the tack lashing on the lower end of the gaff removed, at the same time slacking up the forward masthead stay and hauling taut on the after one, until the masthead falls forward on a line with the stern. The tack of the sail is now swung aft, always on the lee side of the mast. As the tack is carried aft the bow swings off, and what was formerly the stern now becomes the bow, which now points to windward. The tack is lashed to the pin at the bow, the sheet hauled in, and the canoe is on her course, having made little or no leeway, the time occupied being not over half a minute. While a canoe can not be put about as quickly as a sailboat, yet the quickness with which everything is performed is remarkable considering the number of things to be done.

The steering is done with a paddle 10 feet long; near the upper part of the blade is attached a lanyard, half the length of the canoe, the end of which is made fast under the lee platform. When all is ready for tacking, the man steering drops the paddle overboard and stands by to receive the tack of the sail as it is swung to him. Having secured it in position he hauls taut the mast stay, sees that the spilling line is clear and ready for use, and then takes the part of a lookout. In the meantime the other man has hauled in the sheet, made it fast, picked up the paddle which was floated aft, and becomes steersman. Thus they alternate in positions.

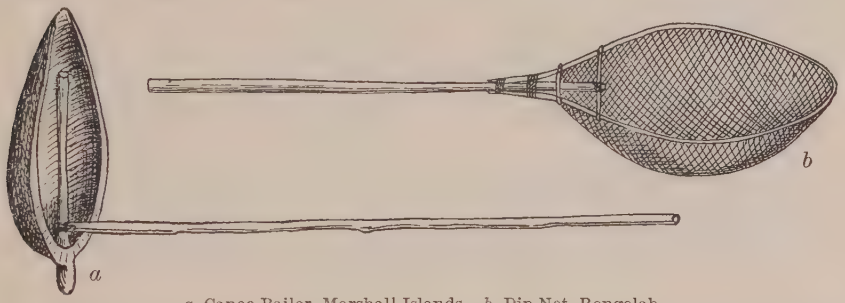
At times considerable water is taken in, and as the canoe is deep it necessitates a long-handled bailer, which is similar to the one noticed at Nukutavake, with a stick lashed to the handle for lowering it into the bottom of the canoe and hauling the water up.

Considerable care is taken of the sails, as they last but a short time if not protected from the weather. When the canoe is not under way the sail is lowered, neatly furled, and covered with mats, the mats made to fit the sail. When a shower comes up while making a passage, the sail is lowered and furled and the canoe is allowed to drift until the rain passes over.

On the morning of January 14 the *Albatross* steamed out of the lagoon through the pass on the south and west side of the island. The

rim of the atoll is very open here and there are many cuts where the sea enters at high water. Many bonito and flying-fish were schooling off the cuts and along the fringing reef. On the following morning we arrived off the southern end of Elmore or Odia Atoll. Skirting along the shore to the westward, we saw no huts or other signs of habitation until we approached a narrow cut leading into the lagoon; here five people were fishing with dip nets and spears. The fringing reef on this side of the atoll is very narrow, as are the beaches. We frequently ran into schools of flying-fish.

Late in the afternoon we arrived off Namu Atoll, approaching it from the south side. The beaches are narrow, with considerable rock scattered over the ground. The rim of the atoll is broken into many islets. Near the edge of the reef were numerous fish jumping. Two natives were fishing with hand lines from a canoe and several more people were fishing on the reef. A mile or so away smoke was seen



a, Canoe Bailer, Marshall Islands. *b*, Dip Net, Rongelab.

rising from among the palm trees, indicating the presence of a village. Shortly after we ran into an immense flock of birds feeding on crustacea or small fish. Bonito in considerable numbers were about, evidently feeding on the same material.

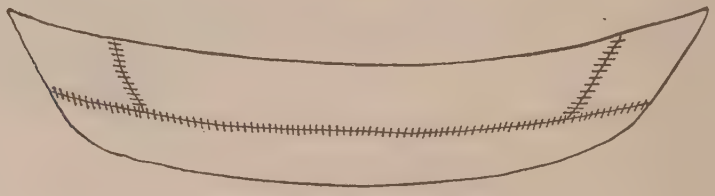
RONGELAB ATOLL.

In the afternoon of January 17 the ship entered the lagoon of Rongelab Atoll and came to anchor off the village on Rongelappelap Island, one of the most northern atolls in the Ralick Chain, 380 miles from Jaluit. In the immediate vicinity of the village there are no seining beaches. About a third of a mile to the eastward there is a small, smooth beach, and near the entrance to the pass there is another which covers a considerable stretch of ground. At all other places as viewed from the ship the shore presents a very rough appearance. We observed no reefs or pools such as are found at most atolls.

In the evening hand lines were put over the ship's side in 25 fathoms of water; character of bottom very rough. Sharks were plentiful, carrying away most of the hooks and sinkers. Two fish were caught. The surface electric light attracted a few small forms of animal life.

There was a scarcity of fishing apparatus to be found at Rongelab. We saw no wicker-work fish-traps in the village or stone traps about the island. Shell fish-hooks, 3 dip nets, and 2 small pieces of net were observed, the net the size of those used at Jaluit in connection with the string of cocoanut leaves. Probably these were used in the same manner. The dip net used by these people is 3½ feet long, 13 inches wide in the center, and tapering toward the outer end and at the handle. The handle is 6 feet long and 2 inches in diameter; size of mesh in net 2 inches. The bow is cut from two pieces of wood, flaring out at the top edge, forming a thin lip turned outward. The outer part of the bow is jointed together and seized; the inner ends are fastened to the handle by two neatly-worked grommets. The handle extends into the body of the net 14 inches, and across the end of the handle is a spreader or brace.

Three sailing canoes were hauled up on the beach and, like those of Jaluit, they were well protected from the weather. They were found to be the same build and rig as the Jaluit canoe, excepting that on the



Showing Build of Rongelab Canoe.

weather platform there is a bunk house 6 feet long, 4½ feet wide, and 2½ feet high; frame made of withes and covered with coarse matting of pandanus leaves. This apartment is occupied by women and children, when they are on board; at other times by the men.

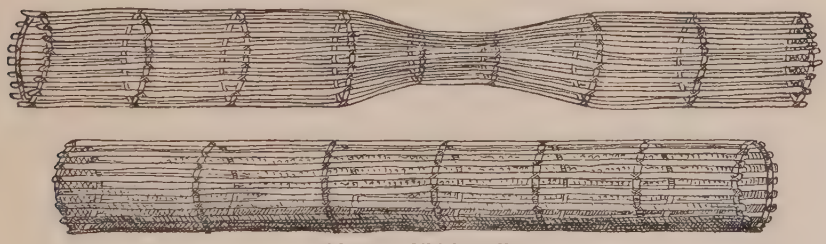
While the small canoes are of the same type as the large, they are invariably made of fewer pieces, always five; at least all those we saw were made of that number; the bow, stern, and bottom are dug out of one piece. Unlike the small canoes of Jaluit, these carry a sail. The mast is unshipped each time the sail is taken in, and is handled in the manner of a spritsail. Instead of from five to seven shrouds, as the large canoes have, there is only one, set up with a toggle at the outer end of the outrigger frame.

LIKIEB ATOLL.

On the morning of January 18 the *Albatross* left Rongelab Atoll. When off South Pass many flying-fish and bonito were observed. On the morning of the 20th we arrived off the southwest end of Likieb Atoll, about 135 miles from Rongelab. This atoll belongs to the Ratack Chain, which lies to the eastward of the Ralick Chain and parallel to each other, both comprised in the Marshall Archipelago.

A mile or so from the shore the beach has the appearance of being perfectly smooth, but on nearer approach a fringing reef covered with old coral comes into view. Near a narrow cut on the west end of the beach is a long wall of upheaved beach rock, and across the mouth of the cut are scattering bowlders; immediately on the inside of the cut the bottom is quite smooth. We subsequently learned this to be one of the native fishing-grounds. The beach above the reef on either side of the cut is composed of very white sand, and makes off with a gentle slope; the reef also makes off quite level.

South and east of Mat Island is a chain of islets, with submerged reefs between. The islets vary in size and shape, each one encircled by a sandy beach. A few of the reefs, or broken parts of the atoll rim lying between the islets, are out of water; at high tide and when the sea is running high they are awash. Further to the south the reefs are covered with small bowlders and patches of live coral. Two islets inside the lagoon afford the only places in this vicinity where collecting with a seine might be carried on with success.



Fish-traps, Likieb Atoll.

There are no seining-beaches near the village, the entire shore being covered with fine coral. At a point some little distance to the northward is a sandy beach where collecting may be done at high water. Just below low-water mark a profusion of coral heads appear. Our time being limited, we did no shore collecting.

In the evening the usual number of hand lines were put over the ship's side, and a crab net and fish-traps were set, but without results. A few gar-fish, shrimp, and a number of small fry, which had the appearance of young sardines, were attracted by the surface light and taken in dip nets. Some 20 feet below the light were some large fish, but they would approach no nearer.

The fish-traps are constructed on the order of a fyke net and similar to the salmon stream traps used by the Indians of southeast Alaska. They are cylinder-shaped, 8 to 12 feet long, and 10 inches in diameter, and are much less complicated than those seen by us elsewhere, consisting merely of a number of wooden hoops set 12 to 14 inches apart, having withes and bamboo strips seized on the outside; spaces between the strips, 2 inches. Some of the traps have one end larger than the other. The lower or bottom end is covered with a piece of webbing,

easily put on or removed. This style of trap is used in narrow cuts and channels, or in other places where fish may be driven.

Traps are placed near the entrance of channels and narrow cuts, or in rock pools on the reef. When fish are seen near the mouth of a channel, a trap is placed in it and there is an effort made to drive the fish into the channel. In many instances this proves a success. By forcing the fish into the narrow passage, more or less of them must necessarily enter the trap. The trap is then taken out, the contents are emptied upon the beach, and a lookout is kept for another school. The morning or evening is the most favorable time for taking fish in this manner.

Hook-and-line fishing is also carried on in the morning or in the evening just before dark. Rods are generally used, the fishermen standing on the coral rock, casting out into deep water. American and English hooks are preferred to their own make. In trolling in the passage or outside the lagoon for bonito or other fish a steel hook is used in connection with the pearl-shell hook, the native hook being fastened above. The bright color of the shell hook attracts the fish, at which he bites. If he escapes, he is generally caught by the other.

In capturing fish of all kinds on the reef, spears made of common rod iron and fish-hooks straightened out are used. Turtle are taken at all seasons, mostly on and around isolated islands. Flying-fish are most abundant from January to May. They are caught at night, being attracted to the canoes by torches and scooped up in dip nets, all of the canoes of the village engaging in the fishery.

At Likieb we found the same style of sailing canoe as at Rongelab and Jaluit. The small canoes, however, differ slightly; some are fitted with sails, while others of equal size are wholly propelled by paddles. There is not the noticeable difference between the lee and weather side of these canoes as compared to those at other islands in the Marshall Island group. Neither is the same style of top plan strictly adhered to. Some changes also have been made in the bottom; the change has come about gradually, covering a period of about fifteen years. The following are the dimensions of one of the old-type canoes: Length over all, 13 feet 2 inches; 7½ inches from the gunwale to the water line, and 16½ inches from water line to keel, making a depth of 24 inches; width, 15 inches; very sharp on the bottom, with the weather side slightly rounded out. Outrigger float, 8½ feet long, 7 inches wide, and 6½ inches thick. The outrigger frame is made up of 5 crosspieces, with a backbone of 2 larger pieces, the light ones being fastened to the weather gunwale, the heavy pieces to both gunwales. On the outrigger side there is a platform 24 inches square and on the lee side one 22 inches square, both raised 2½ inches above the gunwale.

The other canoe, which is a departure from the old style, is flat on the bottom and is deep in proportion to the width. Although flat

on the bottom, it would not remain upright on the water without the outrigger. The float is the same as on the large canoes. The outrigger frame is a rude affair, made of two strips of joist nailed together. The canoe itself is made of logs in the usual manner and fastened with cocoanut fiber. Forward and aft of the outrigger frame is a half-deck. This leaves an opening on either side of the crosspieces to stand in when paddling. A canoe of this kind was just finished and ready to put in the water, with the following dimensions: Length, 15 feet; width, 17 inches; 1 foot wide 2 feet from the bow and the same width 2 feet 7 inches from the stern; waterways all the way round, 4 inches wide, except where joining to the solid part of the bow and stern—at these points it narrows to 2 inches; outrigger float, 13 feet long, $9\frac{1}{2}$ inches wide, and 8 inches thick; distance from the side, $7\frac{1}{4}$ feet; the outrigger frame consists of two pieces of joist.

A canoe was being constructed out of boards on the plan of a dory, with an outrigger like the one just described. The old method of canoe-building is being abandoned gradually, and in a few years the large sailing canoe, and also the small ones, will have disappeared.

At this late day no very long passages are made in canoes; formerly, before the introduction of sailboats and schooners, canoes of large size were common. Inquiring into the merits of the sailing canoe as compared to the average sailboat of equal length, we were informed that a canoe in windward work, when the sea is choppy, is not equal to a fast-sailing boat, but with a beam wind and running before it she is superior. In beating to windward the canoe is somewhat handicapped by the large amount of water she takes in, and in a rough sea almost constant bailing is required. While the canoe possesses fairly good seagoing qualities, white people living in the islands claim that it falls short of the average boat for all-round work. Formerly many canoes were lost in making passages to distant islands.

A Portuguese from a whaling ship landed on this island about forty years ago and shortly after married a native woman and became a trader. With him was the beginning of a change in affairs pertaining to the island. We were informed by him that a number of years ago Capt. Charles Foster, of Oakland, Cal., built a 40-ton schooner here, and among those whom he had to help him were the two sons of the Portuguese trader. From Captain Foster they learned much about shipbuilding, and soon began building boats and schooners for themselves. That they have progressed wonderfully is clearly shown in the schooners and boats launched from their yard, which compare favorably with many of those built in California and brought here to sell.

The shipyard is on the beach at the village. It is sheltered from the rain and heat by a high roof. Tools of all kinds, such as used in a shipyard, were lying about, and some of the most improved make.

The sailboats built here vary in length from 22 to 35 feet, equally divided between the square and sharp stern. A schooner of about 12 tons, recently launched, lay at anchor in the lagoon. On being asked the cost of such a schooner ready for sea, the builder stated that if a chief should purchase her the price would be $1,000, but that any other person could purchase her for considerably less. Nearly all of the chiefs in these islands are wealthy and the other natives correspondingly poor, hence the two prices. Even the poorest person among the natives aspires to have a small schooner.

The knees and timbers for vessels and boats are cut on an island on the western side of the lagoon. The wood is called "kauoe," and looks like black walnut. With age it becomes very hard, and is said to be as durable as oak. The wood used in other parts—such as plank, spars, booms, gaffs, etc.—is shipped from New Zealand.

WOTJE ATOLL.

Just before dark, January 21, the *Albatross* entered Rurick Pass, Wotje Atoll, and came to anchor in the lagoon in 25 fathoms of water. Here the surface light attracted but a small amount of life. Hand-line fishing was a failure. The rim of the atoll here is nearly submerged, there being but few places where the sea breaks in ordinary weather; but the submerged part of the rim could be plainly seen, reflecting a pale greenish color along the middle, intermingled with bluish tints at the edges, which, combined with an occasional comber, breaking and splashing its white foam in streaks over the surface, made a strong combination of colors. The main channel could be distinguished by its water being the same color as the sea outside.

The following day we entered the passage on the southern side of the atoll, steamed across the lagoon, and anchored off the village. The inhabitants number about 200, and seem to have had little communication with the outside world. The beaches are smooth high up, near the margin of the palm trees, but rough a short distance below. No seining was done; neither were any fish seen near the shore except two sharks about 200 yards from the beach.

The canoes at this island did not differ noticeably from those at Jaluit and Rongelab. Two styles of fish-traps are used—the one described at Jaluit and that mentioned at Likieb, the latter being the more common. One cylinder trap was 14 feet long. The man who owned it was not inclined to part with it at any price. No spears, nets, or other fishing apparatus were found in the village.

In the evening a considerable amount of minute surface life was collected and 3 specimens of coral-fish. Among the other fishes attracted by the light and captured were half-beaks and a species resembling young herring. Several natives, returning from a fishing trip, came on board with 2 craw-fish, which were purchased and placed in alcohol.

ARHNO ATOLL.

Early in the afternoon of January 24 we entered Dodo Passage, 160 miles from our last anchorage, steamed along the shore of the lagoon, and came to anchor off Terranova village.

Hand-line fishing from the ship was not very successful, and fishing with traps was a complete failure. The surface light was the means of attracting coral-fishes, young octopus, a small eel, several species of small fry, a number of annelids, and various forms of crustacea.

For several miles each side of the village the reef on the lagoon side is very rough and jagged, and several trials with a seine proved a failure. At extreme high tide it is possible to use a seine to some advantage, provided the fish come close inshore; otherwise nothing can be accomplished with this apparatus. In subsequent trials with a 15-foot seine over the same ground we came across a small sandy spot, in a bend partially hidden by coral bowlders, where 15 mullet and 2 bonito were taken. On the outside reef, in the rear of the village, we found a mass of coral slabs, forming a sea wall all along the beach, protecting the cocoanut and pandanus trees from the surf. Just below the wall is a strip of sandy beach 25 or 30 feet wide, suddenly merging into a smooth, level platform, on which we found many pools. The platform averages 300 feet in width, upon which the sea breaks heavily, sweeping over it at a depth of a foot or more, filling the pools and churning the water into foam. Many fish were seen darting in every direction. At another time we visited the reef when the tide was out. A heavy sea was breaking against its outer edge, sweeping part way up the platform. Fish were plentiful, but owing to the clearness of the water the seine failed to capture any, although a small collection was made with a dip net in the pools farther up. No natives were fishing at the time. We were informed that the short square net and rope of cocoanut leaves were employed and that hours were frequently spent without taking a single fish. At other times large numbers are captured in a few trials. Much depends on the state of the tide and the force and direction of the wind. Under these circumstances we were not surprised at the smallness of our catch.

Late in the afternoon of the same day we landed on an island in the lagoon, about three-fourths of a mile from the ship and about the same distance from the main shore. At the time of our arrival a heavy rain squall came up, which lasted until dark, preventing us from testing the ground with a seine. Earlier in the day a party anchored in the dinghy off the island close to the shore, among a lot of coral heads, two natives selecting the places for fishing. In trials lasting about three hours 7 fish were caught, among which were 4 species. The only bait which they could be induced to take was hermit crabs.

Three miles to the north and east of Terranova lies another village, and about halfway between them are three stone traps and the ruins of several others, built of coral slabs and pieces of broken coral.

The canoes observed at Arhno were small dugouts and require no special mention.

On the morning of January 28 the *Albatross* left the lagoon and made a detour around the northern shore of the atoll, thence skirting along the western shore. Here the rim of the atoll is submerged in many places, forming many islands, some of which are inhabited. We were told at Jaluit that this atoll supported nearly 2,000 people, but saw nothing to lead us to believe that such a number exist here. In coasting along the shore we saw many fish-traps.

At the islands we visited in the Marshall Archipelago the contrast between the build of the canoes and that of the houses was very noticeable. Much care is taken in the make of the former, but very little in the latter. In all other groups visited well-made houses and huts were noticed.

THE CAROLINE ISLANDS.

On the 29th we arrived at Jaluit and remained there till February 5. Leaving the Marshall Islands, the ship proceeded to Kusaie, the most eastern island in the Caroline group, a little over 400 miles from Jaluit, and came to anchor in Port Lottin, the most southern harbor on the island. The island is volcanic, 8½ miles long by 5½ miles wide. Its highest point is 2,155 feet. A heavy and luxuriant growth of vegetation covers the entire island almost to its highest part.

The harbor is small, and is fringed with coral reefs on the east and west sides; at the head is a long stretch of sand and mud, forming a bar, which at low water is bare. The bar has been formed by two small rivers that empty into the harbor above. About 150 feet is the average width of the rivers at their mouths, narrowing to less than 50 feet half a mile up; the depth varies from 2 to 5 feet, with an occasional sand bar where a canoe will barely float. The village is on the east side of the harbor at the mouth of the river.

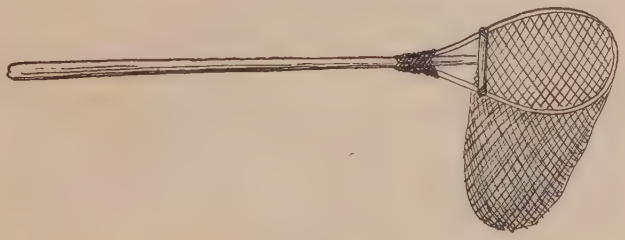
In the rivers were many small fish, but repeated trials and failures demonstrated that they would not take a hook. A fair representation of the fishes inhabiting the rivers was taken in a small collecting seine. A large seine can not be hauled, owing to the tree stumps and branches strewn over the bottom. Two large eels were caught and off the mouth of the river, inside the bar, several hundred mullet were taken.

Very little hook-and-line fishing is carried on by these people. Nets are used for the most part, although spears are sometimes operated on the reef. Women do all the fishing, we were informed, and during our stay here we saw no men taking part in it. This is probably due to the fishing-grounds lying so close to the village, protected from the sea. The fringing reef on the south and east sides of the island makes

off a considerable distance, in some places a third of a mile, in others a few hundred feet, forming a shallow lagoon, in which fishing may be performed in all weather. During a storm, when the sea is breaking on the outside reef the lagoon is smooth.

The reef nets are 75 to 100 feet long and average 8 feet in depth, with a 3½-inch mesh. They are made of two-stranded cocoanut fiber, which is strong and capable of bearing considerable strain; floats of koa wood, 6 inches long and 2½ inches in diameter, are placed from 4 to 5 inches apart. On the foot line are heavy shells. These nets answer every purpose of a seine, though not used in the same manner. They are not dragged, chiefly on account of the rough bottom; neither is a canoe used in setting them.

From 10 to 12 women gather a net up in their arms and carry it to the edge of the lagoon, where they wait for the appearance of fish. When a school or a number of fish is seen the women form a semicircle, carrying the net in front of them, wading out and dropping it around the place where the fish were observed, and quickly drawing



Dip Net, Kusaie.

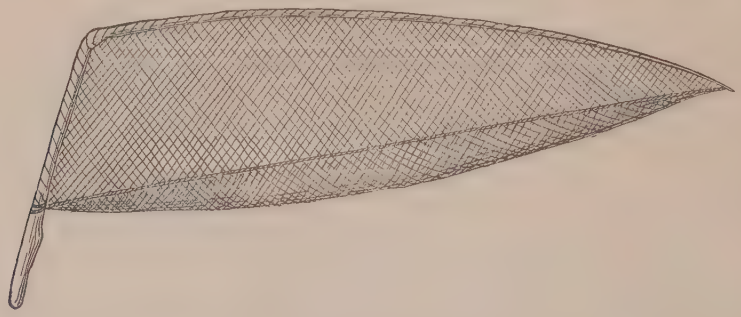
together the ends. The two women holding the ends begin beating the water with sticks, to frighten away from the mouth any fish that may be near it. Soon one of the women steps over the net and also splashes the water with a stick. This causes the fish to scatter, many of them jumping over the cork rope. Fish that jump over the net are prevented from making their escape by a second net, 20 by 8 feet, attached to poles, the poles resting on the bottom and held at an angle.

The hand net is hung so as to form a kind of bag into which the fish fall. In addition to the square hand net for capturing fish that jump over the cork line, large dip nets are held in readiness by the women stationed along the outside. Finally, the large net is gathered into a small compass, picked up, and the contents are emptied into the baskets. After a haul has been made, the net is carried to another part of the lagoon or reef and is again set. This performance is frequently repeated with no success.

Our experience had been that few fish could be approached near enough to capture with a seine, even when exercising great caution, and how these people managed to capture a single individual with such rude apparatus was to us a source of considerable wonder.

The dip nets used in connection with the reef net are 9¼ feet long, including the handle; net part or bow, 44 inches long by 28 inches wide, tapering where it joins on to the handle. The bow is made of withes, the net of cocoanut thread, and the handle of koa wood. The material of which the net is made is very light, which makes it easy to handle. It differs in style from most dip nets in having a deep bag varying from 18 inches to 2 feet. The extra length of bag is for carrying fish while wading in the water over the reef.

Considerable success is obtained with a wing-shaped hand net 3 to 4 feet in length and 18 to 22 inches in width, the greatest width being next the handle, tapering toward the outer end. In fishing on the reef, in pools, or in streams they take the place of dip nets, and are more effective, being easier to handle on account of their lightness and shape. The material of which they are made (pandanus) is strong; size of mesh, 2 inches. These nets are used to advantage among bowlders on the reef and in streams where fallen limbs and snags are numerous. Women and young girls operate them mostly, although

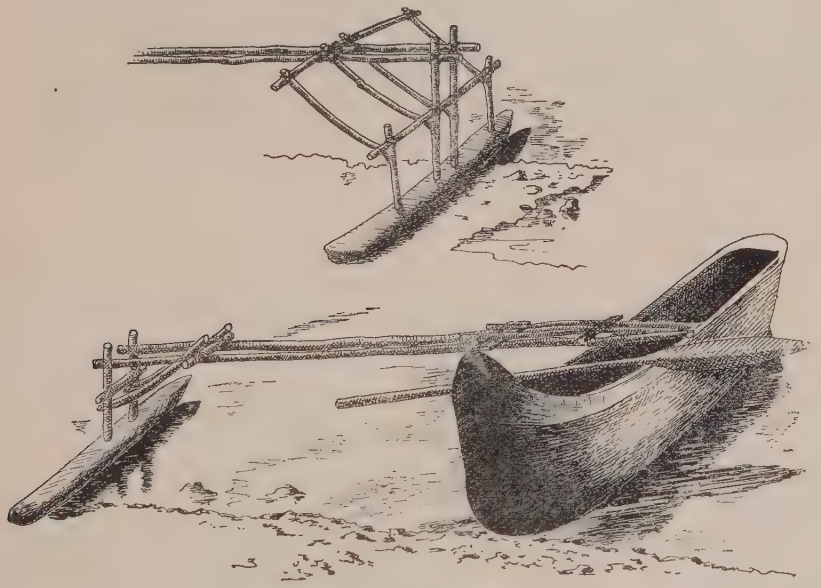


Wing-shaped Hand Net, Kusaie.

boys sometimes take part. In the lagoon or on the reef fishing is performed some little distance from the beach, gradually working in shore. By wading out from the shore and working toward it double the amount of fish are taken than otherwise would be, because when a fish is startled from its hiding or feeding place its natural tendency is to escape into deeper water. In doing so it immediately comes in contact with the barricade of nets. Each person carries two nets, one in each hand. As the fish dart out from behind rocks or other places of concealment a net is dropped in front of them and they are captured. Sometimes the net in one hand is used and sometimes the other, it depending on the movements of the fish. In addition to the nets each person carries a short stick with which to beat the water and turn over stones. Frequently small boys are pressed into service, they standing at the water's edge, turning over stones, and keeping up a splashing of the water, the fisherwomen on the alert with their nets to capture fish that may come their way. When a dozen or more people are in line along the beach it is quite difficult for all the fish to make their escape.

In company with Dr. Woodworth the writer visited a village about 5½ miles from Port Lottin, on the east side of the island, not far from Chabrol Harbor. About half the distance led us up the river emptying into Port Lottin Harbor. We were taken in a canoe poled along by two natives. On the left bank of the stream is an impenetrable network of mangrove trees; on the right bank are vegetable ivory and palm trees, their tops forming an arch over the stream. The stream is said to contain a variety of fish, but very hard to catch.

The village consists of a single row of houses built close to the beach, and in front of each house is a fishing-ground. Some women were starting out on a fishing excursion in the lagoon, where at low water the depth is about 3 feet. At high water the sea breaks over the



Canoe and two Styles of Outrigger, Kusaie.

outside reef, bringing in quantities of mullet and other species, the outgoing tide leaving some of the fish in the shallow water of the lagoon. The fishing party had a reef net, 2 pole nets, and 3 dip nets. There is fully as much sport as labor connected with the fishing, for a great deal of the time playful antics are kept up, the young girls taking special delight in playing pranks on the older women, such as tripping them up, sending them sprawling into the water, throwing dip nets over their heads, and finally all becoming engaged in a friendly fight. If no fish are taken at one tide it matters but little, for an abundance may be caught the next. A half or even a whole day thus spent with meager results seems to amply repay these people for time and labor expended. Hand nets, previously spoken of, are used on the reef and also in the stream.

All the canoes that came under our observation were dugouts of inferior make. Most of the harbor canoes are propelled by poles, some fitted with sails. In times past it is stated that sailing canoes of large dimensions were common in all parts of the island; but for many years there has been no occasion to build canoes larger than is required around the harbor and in the lagoons. In the rare visits to other islands passage is taken on some coasting vessel.

A variation from 14 to 28 feet was noticed in the canoes on this part of the island. The 14-foot canoe is on an average 11 inches wide and 10 to 12 inches deep; thickness at the gunwales 1 inch, increasing to 1½ inches at the bottom, and a considerable thickness of wood at the bow and stern to give strength; round-bottomed; straight fore and aft, and 2 to 3 inches wider at the turn of the bilge than at the gunwale. The outrigger float is 10 feet long and attached to the frame 6 feet from the side; crosspieces of frame 9 inches apart; stanchions connecting float to the frame 9 inches high. Two forms of outrigger frames are common, both shown in the sketch. The sailing canoes have thwarts, generally four, three on the forward side of the out-rigger frame and one on after side. Besides the thwarts there is a wide piece of board fitted across the gunwales 3 feet forward of center, through which the mast is stepped, the step consisting of a piece of wood with a hole mortised in it and nailed to the bottom of the canoe.

Mat sails long since went out of use, and sails are now made of drilling, patterned after those of a cat-rigged boat—high peak and low boom; but unlike the cat-rigged boat these sails are unshipped. One canoe was seen under sail, and contrary to any other sailing canoe we had seen she was handled in the same manner as a sailboat, that is, she was put about on opposite tacks. This being the first time we had seen a canoe handled in such a manner, we were greatly interested. The wind was light and the sea smooth. When brought to leeward the outrigger buried itself. Had the wind been fresh, accompanied by a choppy sea, we could see no reason why the canoe should not capsize. This kind of sailing might be practiced in smooth weather, but in rough weather it is doubtful if it could be done without some danger.

The floats of the outrigger of canoes used in the streams are considerably turned up at the forward end to prevent them from catching under logs, limbs, and twigs. The necessity of this was fully demonstrated in our trip down river, for in many cases the float ran up over branches and other obstacles protruding from the river bank, causing the whole structure to twist as if it were about to break. In coming down river it is quite impossible at times to avoid these obstacles, especially when making a sharp turn. In a number of instances the outrigger shot under projecting limbs and half-sunken trees, bringing the canoe up all standing crosswise the stream. No damage was done other than taking in water. Had the outrigger been put together with nails the whole thing would have been carried away.

CANOE, KUSAIE, CAROLINE ISLANDS.

PONAPI CANOE.

PONAPI ISLAND.

A run of 150 miles brought us off Pingelap Island, where we arrived early in the afternoon of February 10. We did not land, all photographic work being performed from the ship. While lying to, several canoes came off well filled with people, among whom were the king and a white man. Pingelap is a small island about 5 miles long by less than 3 wide, yet it supports nearly 1,000 people. All the canoes that came off were small, estimated length varying from 14 to 16 feet—the same type as the Arhno canoe. While lying to, several large schools of flying-fish passed us; barracuda were also plentiful, and on the passage to Ponapi both species were frequently around the ship.

We dropped anchor in Kiti Harbor, Ponapi Island, the following afternoon, February 11. The inhabitants do not seem to be much given to fishing; at least it is not so extensively carried on as at Kusaie. Here the fishing is performed chiefly by the men. Both the outer and inner harbors are surrounded by reefs. A mountain stream empties at the head of the inner harbor.

Hanging up in a shed with canoes were reef and hand nets, the same as used at Kusaie. The spears were fish-hooks straightened and lashed to poles. No other kind of fishing gear was observed. At low tide in the inner and outer harbor reefs and spits are exposed, just such places where rock pools are numerous and fish abound.

There are no seining beaches in the harbor, all the reefs and spits being too rough for seine work. About half a mile from the mouth of the stream a 50 and a 15 foot seine were dragged. Like most streams in the Tropics, it was filled with snags, there being few places free of them. In eight trials 6 mullet, a number of half-beaks, and considerable small fry were taken. In and about the mouth of the stream the bottom is largely composed of stones and broken coral. Several trials were attempted here, and each time a number of fish were in the seine, but the seine would "foul" with rock, snag, or coral, and before it could be cleared the fish escaped.

A party rowed up the river about 2 miles and tried for fish with rod and fly and bait. Nothing was caught; not even a bite was felt, although an abundance of fish was seen. To obtain a collection representing even one-half the fresh and salt water species to be found here would require many days of patient fishing.

On one of the reefs in the harbor, about a mile from the village and not far from our anchorage, a collection of star-fishes, shells, annelids, and crabs was made.

There is not the marked difference in the size of the Ponapi canoe as noticed at many other islands. A difference of 2 feet is the maximum; average length, 26½ feet; width, 13½ inches; depth, 17½ inches. Outrigger float, 20 feet long; stanchions connecting float to outrigger

frame, 18 inches high; crosspieces to the frame, 3 feet 5 inches apart; platform, 23 inches wide and 41 inches long, built out 18 inches on the outrigger side. Each canoe has 6 thwarts, 3 forward and 3 aft of the platform. Between the crosspieces which form the bed of the platform are 4 other pieces, and under these are 3 others running at right angles to the top ones and parallel with the canoe, forming a bracework to the outrigger frame. We saw no built-up canoes; all that came under our observation were dugouts, but much lighter than any met with elsewhere. The model is fine and well proportioned. The bow commences to turn up abreast the end of the float, extending out gracefully, slightly flaring at the extreme end, but fairly sharp where it enters the water. The stern runs out in the same manner and forms what might be termed an overhang. Stripped of the outrigger and rigged with mast and sail these canoes would look very much like a small modern yacht. To add to this appearance they are painted with a native dye which gives the wood a decided mahogany color, the dye, or paint being put on very skillfully.

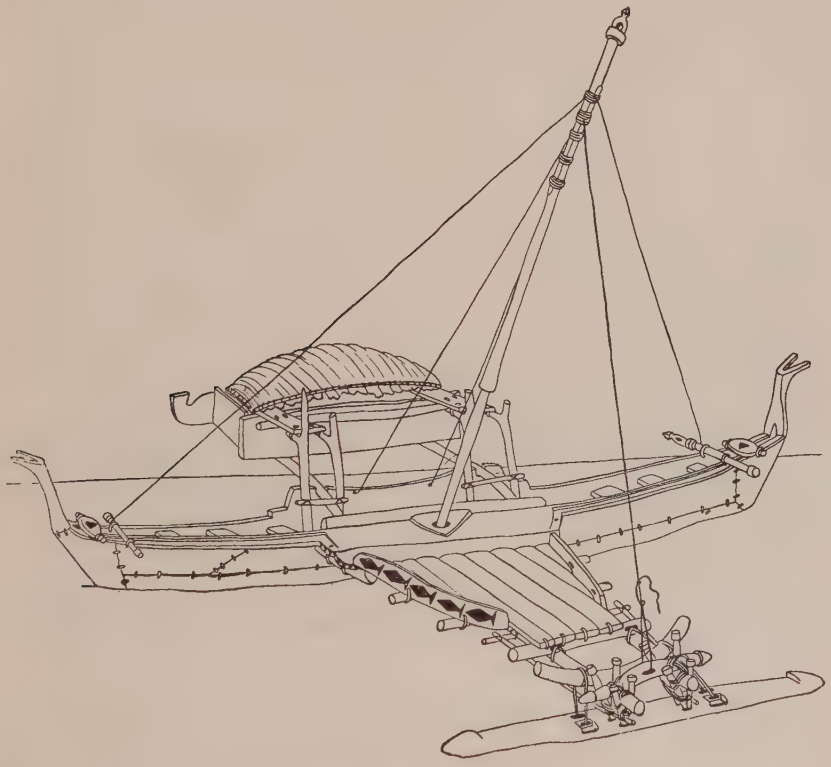
The crosspieces and entire framework of the outrigger differ from those of any canoe previously seen. Heretofore the outrigger float had been joined to the frame by stanchions in the middle; in these canoes not only have they the middle stanchions, but also a set of three on each end. The end ones, however, instead of being fastened to the frame, are attached to a brace which projects from the side at either end. The braces start from the side of the canoe at a sharp angle, meeting in the center of the outboard end of the outrigger frame. The end stanchions are composed of withes, projecting out horizontally from the brace to a point directly over the float, then bent at right angle downward and fastened to the float. The middle stanchions are also withes 3 feet 5 inches apart, each set made of six small withes placed close together at the top and spread at the bottom. The outrigger, though light, is strong and durable.

The platform which covers the middle of the canoe is braced and counterbraced, and, unlike the Marshall Island canoe, is set low. The thwarts are flush with the gunwales, dovetailed in. On different parts of the outrigger frame, particularly on the float where the stanchions join, are fancy cross-seizings of cocoanut-fiber thread. Some are to give additional strength, others are purely ornamental. Every part of the Ponapi canoe is well proportioned, and the workmanship would do credit to skilled mechanics.

On the part of the island which we visited there is an absence of sailing canoes; we saw none fitted with masts or sails, neither did we see any sailboats. Usually, even in isolated islands, where the people have long mingled with civilization, modern sailboats are found. It is presumed that modern tools are used in building a class of canoes so nicely finished as these.

TRUK GROUP.

Leaving Ponapi on February 12, the *Albatross* headed for the Truk Group—a part of the Caroline Islands nearly 400 miles westward of Ponapi. In the afternoon of the 14th the ship lay to off Namo Island, and in the evening canoes came off. Torching for fish on the reef and beach continued from dark until after midnight. We did not land to see the fishing, and it was too dark to examine the canoes that came off to the ship.



Sailing Canoe, Truk Group.

The following morning we passed through the outer rim of reefs encircling the Truk Group and anchored on the west side of Moen Island off the village. Truk Group consists of 13 islands and numerous islets encompassed by a series of broken reefs 35 miles in diameter. Many parts of the rim are submerged with islets between, some of which are barely above the surface at high water. The present condition of the atoll rim seems to indicate that at one time it was wholly above high-water mark, but has gradually subsided, leaving only the most prominent parts exposed. In most parts the reef is quite wide, in a number of places a mile or more, over which are scattered many bowlders of old coral rock.

For several miles, commencing at the village and running to the northward, is a series of smooth beaches, interrupted by an occasional stretch of coral. All of the beaches make offshore for some little distance. Some are protected from the wind, which has a long sweep across the lagoon, by islets lying from a quarter to a half mile offshore. In these sheltered places women were fishing with hand nets at the time of our arrival. It was noticed here, as at Kusaie, that in connection with fishing more or less play was indulged in. No men were engaged in fishing or any other labor, probably because nearly all of the people of the neighboring islands were at war with each other. It is said that the many islets, shoals, and reefs in the lagoon and on the rim of the atoll afford excellent fishing-grounds, where in time of peace the natives of all the islands find fish sufficiently abundant to supply their needs. Each island is practically independent, its surrounding reefs supplying the fish and the hillside yielding all the fruit

Paddling Canoe, Truk Group.

and vegetables required. These people may have different kinds of fishing apparatus, but the only kind in use during our stay was the hand wing-shaped net, as described on page 820.

Our seines were used on the beach for a mile or more north of the village, and about 2½ miles south of it an afternoon was spent in the same work, meeting with considerable success. In the catch were small flounders, mullet, crabs, starfish, and shells. Large schools of mullet kept a considerable distance from the shore, only a few at a time approaching near enough for capture.

In this group there is a wide difference between the sailing canoe and the canoe propelled by paddles. The former, both in construction and general appearance, is similar to that of the Marshall Islands. The latter is a dugout, and in no way resembles the former. Without knowing that both styles of canoes were made by the same people, one would naturally suppose that each had been made by a people entirely unlike in taste and separated by a long distance. The average length of the sailing canoe is 28 feet; width, 16 inches; depth, 37 inches; thick-

ness of planking, 1½ to 2 inches; outrigger float, 9½ feet long and 8¼ feet distant from the side of canoe; crosspieces of frame, 30 inches apart; length of platform on outrigger frame, 7 feet; stanchions connecting crosspieces to the float, 15 inches high, 4 on each, and carved at the top. It will be noticed that the outrigger float, framework, and platform vary slightly from the Marshall Island canoe. The built-up platform on the lee side is also different in detail and like the canoe of Rongelab is covered with a thatched roof. The sail plan and rig is practically the same as the sailing canoes in the Marshall Islands. Mat sails are still used, of the same material as in all parts of the South Seas where cotton has not been introduced. A rudder 4½ feet long, 10 inches wide, and 2 inches thick is used instead of a paddle for steering. It is detachable and is shifted from end to end of the canoe when a tack is

Canoes on Beach, Truk Group.

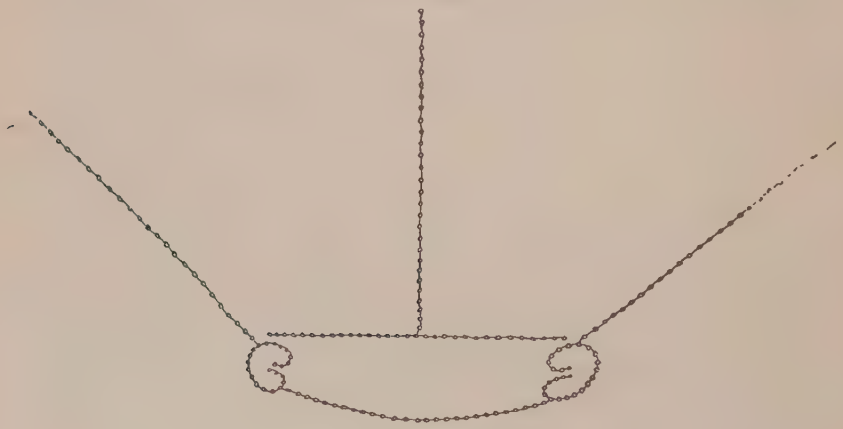
made. It is held in position by a wooden pin against which the top part rests. Round the pin and head of the rudder is a grommet to prevent it from slipping down.

In the village four canoes were building. One had recently been worked on; the others were covered with matting, no work having been performed on them for at least several weeks. Probably the war had something to do with the suspension of labor, not only on the canoes, but with almost everything else. A dozen or more small canoes were about the ship most of the time, manned by half-naked people, whose bodies and faces were decorated with native paint, presenting a barbaric picture. These canoes are ornamented at the bow and stern with carved pieces of wood on the order of a gondola. The stanchions on the outrigger are carved at the top; they are much longer than seems necessary, but without the extra length and the decorations the canoe would not be considered by the natives as finished.

GUAM

On the morning of February 21 we sighted Guam, approaching it from the southern side. At a distance this part of the island has the appearance of the southern coast of California. The interior portion is similar to Makatea, in the Paumotu group, it having a mesa surrounded by perpendicular cliffs. The shore line on the south and east side is fringed with narrow, sandy patches, with an occasional outcropping of coral rock. Passing around the northern end of the island, down the west shore in sight of Agana, gave an excellent view of the coast. Early in the afternoon the ship came to anchor in the harbor of San Luis d'Apara.

In all parts of the harbor the beaches are extremely rough and ragged. At low tide reefs covering large areas are exposed, on which are numerous pools and channels where the natives fish with spears,



Double Fish-trap, Guam.

mostly at night. As observed at most places, reef fishing here at night is carried on by the aid of torches.

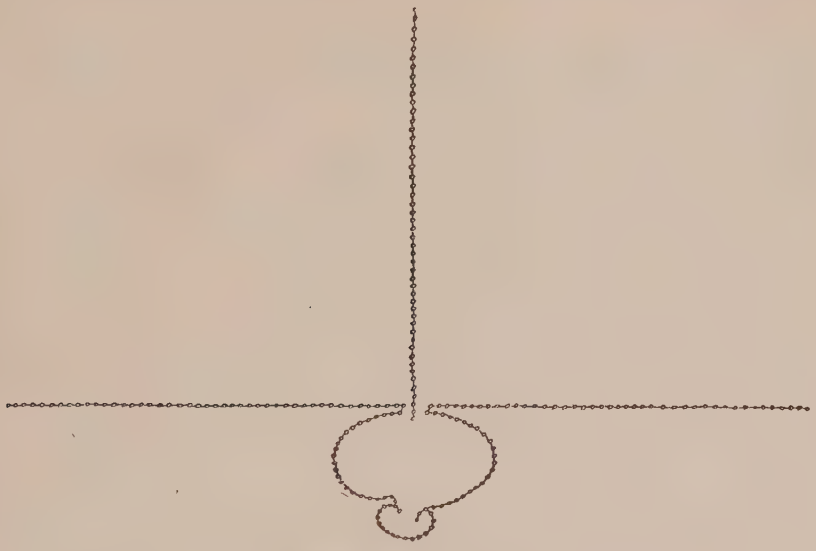
The people of Guam do not engage in fishing as much as most natives in the islands of the Pacific. They are given more to tilling the soil, and fishing seems to be a secondary consideration.

Many of the inhabitants of San Luis d'Apara living near the shore have fish-traps extending out from the beach in front of their houses. The traps are of two kinds —double and single pocket. The pocket of the single trap is about 60 feet in diameter, with two wings 150 feet each, and a lead of 200 feet. The pockets of the double trap are built 60 feet apart and connected by a bamboo fence. From each pocket is a wing varying in length from 100 to 400 feet, according to the location of the trap. The leads vary from 200 to 300 feet.

In constructing traps, bamboo is wholly used. Poles are driven into the sand and coral, placed 4 feet apart, and around them is woven, basket fashion, strips of bamboo twisted into a rope.

Only an inferior type of dugout is now seen; the original design has long since departed. The canoe now used averages 27 feet long, 18 inches wide, and 13 inches deep; width carried well forward; straight on the bottom; little or no sheer, and full at the bow and stern. There is no attempt to decorate these canoes; they are as plain as it is possible to make them.

There is no platform or framework on the outrigger, only two cross-pieces, fastened to the float by wooden pins, and to the gunwales by



Single Fish-trap, Guam.

seizings; outrigger float, made of hard wood, 9 feet long, 7 inches wide, and 8 inches deep; sharp at each end.

On account of the harbor being shallow in most parts very little paddling is done; a man stands in each end and with long poles pushes the canoe along at a good rate of speed. There is very little occasion for going outside of the harbor, which in a measure may account for no larger or better canoes being built.

INDEX.

Page.

Abalone Fishery of California 567, 570, 574
in Hawaiian Islands 374
Abbey & Imbrie 303
Angling Exhibit at Pan-American Exposition 329–332
Abramis crysoleucas 211, 223, 236
Acipenser brevirostris 235
rubicundus 209, 222, 235, 285
sturio 235
æglifinus, Melanogrammus 269
affinis, Atherinops 244
Agassiz, Alexander 743
Aitutaki Island 778
Akiaki Island 765
alabamæ, Alosa 280
Alabama Fisheries, Statistics of 693
Shad 280
Albatross Fishing Trials in South Seas 741–829
Model 306
Operations of 13
Alewife 213, 237
Alexander, A. B 141, 505
Alexander, A. B., on the Boats, Apparatus, and Fishing Methods employed by the Natives of the South Sea Islands, and Results of Fishing Trials by the Albatross 741–829
Alexander, W. D 355, 383, 386
Alofi Village 780
Alosa alabamæ 280
ohiensis 277, 279, 664
sapidissima 213, 237, 277, 281, 504
alosoides, Hiodon 287
Alpena Hatchery 60
Ambloplites rupestris 174, 214, 224, 239
Ameiurus lacustris 222, 235
melas 171, 210
nebulosus 115, 171, 210, 222, 235, 286, 373, 452
American Fisheries Society 18
Mutoscope and Biograph Company 302
Net and Twine Company 303
americanus, Pseudopleuronectes 240
Amia calva 115, 171, 209, 222, 235
Anaa Atoll 755
ancellaria, Physa 175
Anguilla chrysypa 213, 223, 237, 287
anguilla, Ictalurus 286
anisurum, Moxostoma 210, 236
Annin's Egg-transportation Box 315

Page.

Anodonta grandis footiana 175
anomalum, Campostoma 172, 210
Anoplopoma fimbria 525
Anu-Anuraro 768
Apaiang Island 801
Apamama Island 797
Apataki Island 751
Aplodinotus grunniens 216, 225, 287
Apparatus employed in South Sea Fisheries 741–829
Apparatus for transporting Fish Eggs 315
Appropriations 20
Aquarium 319
at Pan-American Exposition 294
Fishes at Central Station 47
Aquiculture and Fisheries, International Congress of 133–135
Argyrosomus nigripinnis 586
prognathus 213
Arhno Atoll 817
Arkansas Fisheries, Statistics of 701–707
Arnkil, V 743
Arorai Island 797
artedi, Argyrosomus 213, 224, 237
Artificial Flies 332
aspro, Hadropterus 215
Astoria Fisheries 544
atchafalayæ, Signalosa 275
Atherina 242
boscii 264
menidia 264
notata 264
viridescens 264
Atherinichthys menidia 264
notata 264
atherinoides, Notropis 212, 223, 236
Atherinops affinis 244
Atherinopsis californiensis 244, 548
atkinsii, Gasterosteus 112
Atkins, C. G 29
Atkins Hatching Crate 318
Transportation Box 315
Atlantic Salmon 25, 30, 43
Distribution of 86
atrimentis, Menidia peninsulæ 258
atromaculatus, Semotilus 112, 172, 173, 211, 223, 236
atronasus, Rhinichthys 172, 212, 223, 236
Atwater, W. O 18
Auburn Lake 111
audens, Menidia 259
aureolum, Moxostoma 172, 210, 222, 236, 287

Page.

Awards by Paris Exposition 18
Babcock, C. H 297, 303
Bacterial Exhibit at Pan-American Exposition 314
Bag Nets used in Hawaiian Islands 399
Bag Seine 326
Bailey, E. H 355, 384
Baird Seine 308, 327
Baird Station 21
  Report 74
Baker, A. C 134
Baker Lake Station 22, 83
Baldridge, L. E 587
Baldwin, A. H 18, 124, 355, 384
Bamboo Fish-car 772
Barbue 235
Bartlett, S. P 62, 304
Bastard Halibut 570
Battery Station Report 43
Battle Creek Station 21, 75, 77
  Report 77
Bawden, Charles 127
Bay Whaling in Hawaiian Islands 485
Beam Trawl 307
Bean, Barton A 142, 209, 217, 227, 241
Bean, Tarleton H 17, 18, 134
Beaufort Biological Laboratory 10, 14, 130
Bêche-de-mer Fishery of Hawaiian Islands 498
Beckley, F. W 355
Belle Isle Fishing Operations 59
Bellevue Collecting Station 64
Bell, W. B 127
Bermuda Fishes at Pan-American Exposition 296
Berndt, E. L 355, 383
Berrian, J. W 80
beryllina cerea, Menidia 261
  Menidia 241, 259, 261
beryllinum, Chirostoma 259
Beshowe 525
bicarinatus, Planorbis 175
Biétrix, Eugene 138
Bigelow, R. P 127
Bill-fish 171, 209
Biological Inquiries 10
  Laboratories 127–133
  Stations of Europe 135–139
Birge, E. A 116
bispinosus, Gasterosteus 214
Black Bullhead 210
Black Bass 50, 53, 62
  Distribution 103
  Hatching 65
  in Massachusetts 26
  Hawaiian Islands 451
  Large-mouth 45, 47
Black-chin Minnow 211
Black Cod 525
Black-fin Sucker 222
Black-nose Dace 172, 212, 236
Black-sided Darter 215
Black-spotted Trout 70
  Distribution of 93
Black Sucker 222, 286
blennioides, Diplesion 215

Page.

blennius, Notropis 211, 223, 236
Blind Eel 222
Blob 174, 240
Blueback Salmon 22, 83, 506
  Distribution of 88
Blue Bream 174
  Cat 286
  Darter 174
  Sun-fish 174
Bluefin White-fish 586
Blue-fish 112
Blue-gill 174, 214
Blunt-nosed Minnow 172, 211, 223
Boats of South Sea Islands 741–829
  Hawaiian Fishermen 394–396
Boepple Button Company 304
Boleichthys fusiformis 215
Boleosoma nigrum olmstedi 215, 225, 240
Booth, A 79
Booth, D. C 71
Bora Bora 777
boreale, Etheostoma 240
boscii, Atherina 264
Boston and Gloucester Fisheries 142, 147–149
  Fisheries 11, 143–144
Bowers, George M 305, 354, 576, 660
Bowfin 171, 209, 222
Bozeman Station Report 73
Bradfield, J. P 302
Brandt, Thorwald 384
brasiliensis, Menidia 264
Bream 68
  Distribution of 109
Breed, Robert S 127
Breme 236
brevirostris, Acipenser 235
Brigham, W. T 355
Brine, Food Products pickled in 344
Brood Cod, Collections of 2
Brook Silverside 174
  Stickleback 214, 224
  Trout 53, 172, 224
    Distribution of 94
    Hatching 58, 63, 69, 71, 73, 80
Brown, E., & Bro 303
Brown, J. E 46
Brues, Charles T 127
Bryan Point Station Report 44
bubalus, Ictiobus 286
Buchanan, W. I 303
Buck, H. H 83
Buffalo-fish, Food of 119
Bullochville Station 14
Bull's-eye Mackerel 569
Bumpus, H. C 18, 36, 121, 127
  Notes on Silversides 247
Burbank, M. A 355, 383
Butaritari Village 802
Cail Fishway 320
Calico Bass 214, 239
California Fish Commission 75
  Fisheries 12, 549–574
  Flounder 527
  Salmon, Natural History of 116
  Smelt 548
californiensis, Atherinopsis 244

Page.

Calkins, Gary N 124
calva, Amia 115, 171, 209, 222, 235
campanulatus, Planorbis 175
Campeloma decisum 175
Campostoma anomalum 172, 200
Camus 235
canadense, Stizostedion 215, 225, 239
Canned Food Products 345, 346
Cannibalism among Fishes 54
Capehart, W. R 50
Capelin Seine 326
Cape Vincent Station Report 38
caprodes, Percina 174, 225, 240
zebra, Percina 215
Carassius auratus 373, 452
Carlton, Newcomb 303
Caroline Islands, Fishing Methods, Apparatus, and Boats 818–827
Carp 172, 287
Fishery of Lake Erie 150, 631
Food of 119
introduced into Hawaiian Islands 452
shipped from Illinois River 677
Sucker 222, 286
carpio, Carpiodes 286
Cyprinus 172, 287
Carpiodes carpio 286
thompsoni 222, 235
velifer 287
Carter, E. N 80
Cast Nets 326
used in Hawaiian Islands 407
cataractæ, Rhinichthys 223, 236
Cat-fish 171, 222
as Consumers of Fish Spawn 120
Distribution of 103
Food of 119
in Hawaiian Islands 452
Catostomus catostomus 210, 222, 235
commersonii 171, 210, 222, 235, 287
nigricans 171
Caviar 581
from Paddle-fish 160, 663
Cayuga Minnow 211
cayuga, Notropis 172, 211
Central Station Aquarium 46
cepedianum, Dorosoma 275, 287
cephalus, Mugil 112
Ceratophyllum 169
cerea, Menidia beryllina 261
Chamberlain, F. M 117
Champlain Lake and Tributary Waters, Fishes of 217–225
Channel Cat 209, 235, 286
Chapman, F. M 127
Chase Hatching-jar 318
Chautauqua Lake, Description of 169
Fishes and Mollusks of 169–175
Muskallunge 172
Cheney, A. Nelson 227, 303
Cheney, J. K 303
cheneyi, Cottogaster 240
Cheney's Darter 240
Chesapeake Oyster Pungy 324
Chevesne 236

Page.

Chicago Fish Trade 614
Child, C. M 115
Childs, H. A 127
China-fish in Hawaiian Islands 452
Chinook Salmon 506
Chirostoma beryllinum 259
peninsulæ 257
Chrosomus erythrogaster 210, 236
chrysochloris, Pomolobus 281
chrysops, Roccus 216
chrysypa, Anguilla 213, 223, 237, 287
Chub 172
Mackerel 569
Sucker 210, 236
Chucklehead 225
Cisco 172, 213, 224
Clackamas Station Report 78
Clam Farms, Establishment of 10
Fishery of California 572
Planting Experiments on Casco Bay 112
Rake 333
Clams, Experiments in Rearing 112, 121, 374
on West Coast 544
Clark, B. C 25, 199, 207
Clark, Frank N 57
Clark, H. W 113
Clark Hatching-jar 318
White-fish Egg-box 315
Clupea harengus 237, 269
pallasi 534
clupeiformis, Coregonus 213, 224
Coal-mining detrimental to Fish Life 121
Cobb, John N 124, 141, 142, 155, 161, 355, 576, 660
Cobb, John N., Commercial Fisheries of Hawaiian Islands 381–499
Cod Box 317
Cod, Distribution of 110
Eggs, Collection of 35, 36, 37
Piebald 208
Propagation of 2, 23
Seine 327
Tagging at Woods Hole 193–208
Trap 327
Cod-fish Business of Pacific Coast 563
Coe, Wesley R 127
cœruleum, Etheostoma 174, 215
Coghill, George E 127
Cogswell, T. M 141, 576
Cohen, Nat 304
Coker, R. E 130
Cold Spring Station 14
Report 54
Cold-storage Fish Business on West Coast 537
Collins, A. L 217
Collins Egg Pan 320
Columbia River Fisheries 536–538
Commercial Fisheries of Hawaii 378–499
commersonii, Catostomus 171, 210, 222, 235, 287
Common Blob 216
Bullhead 171, 210, 286
Eel 213, 223, 287
Pickerel 213
Pike 213
Redhorse 172, 287
Shad 213

Page.

Common Stickleback 214
Sucker 171, 222, 235, 287
Sun-fish 174, 224, 239
White-fish 213, 224
White Sucker 210
Concarneau Seaside Laboratory 138
concolor, Ichthyomyzon 222, 235
Conger Eel 140
Congress of Aquiculture and Fisheries 18, 133–135
Conley, F. G 200
Connecticut Oyster Steamer 325
contectoides, Vivipara 175
Conway, R. J 304
Cook Islands, Fishing Methods, Apparatus, and Boats 778–781
Cooper, H. E 355, 383
copelandi, Cottogaster 225
Copeland's Darter 225
Copper-nosed Bream 174
Coregonus clupeiformis 213, 224
labradoricus 224, 237
quadrilateralis 223, 237
Corliss, C. G 35, 304
cornutus, Notropis 172, 175, 212, 223, 236
corporalis, Semotilus 211, 223, 236
Corsair 572
Coste, M 139
Cottogaster cheneyi 240
copelandi 225
Cottus ictalops 174, 216, 240
Couesius plumbeus 223, 237
Cowles, R. P 127, 130
Crab Fishery of San Francisco 563
Net 326
Crabs on Pacific Coast 544
Craig Brook Station Report 29
Crampton, H. E 130, 132
Crappie 45, 62
Distribution of 107
Hatching 65, 68
Crawfish Business of Portland 545
"Crazy" Fry 125
Creek Chub 172, 211, 223
Cristivomer namaycush 213, 224, 238
Croatan Sound Fishing Boat 326
Crowfoot Dredge 662
Crustacean Exhibit at Pan-American Exposition 310
crysoleucas, Abramis 211, 223, 236
Cultus-cod 525
Curtiss, W. C 130
Cushing, Herbert H 127
Cut-lip Minnow 223, 237
Cycleptus elongatus 286
Cyclopterus lumpus 240
Cyprinus carpio 172, 287, 373, 452
Dahlgren, Ulric 127
Damon, S. M 355, 383
Davenport, C. B 116
Dean, H. D 65
decisum, Campeloma 175
Deep-water Blob 216
Denny, Winfield A 127
dentex, Menidia 264
Detroit Hatchery 59

Page.

Detroit River Fisheries 627–629
Deyrolle-Guillou, Emile 140
diaphanus, Fundulus 34, 112, 213, 239
Dick Thompson Shad 275
Dimick, F. F 142, 149, 304
Diplesion blennioides 215
Dip Nets 309
used in Hawaiian Islands 406
Diseases of Fishes 10, 54, 58, 63, 68, 79, 124, 298
Distribution of Fish and Eggs 3–8
Dodo Passage 817
Dog-fish 171, 677
Dohrn, Anton 137
Dole, E. P 383
Dole, Sanford B 355, 383, 387
Dolly Varden Trout 84
dolomieu, Micropterus 174, 214, 224, 239
Dorosoma cepedianum 275, 287
Downing, S. W 55
Dredges for collecting 308
Dudley, William H 127
Duluth Station Report 60
Dunlap, I. H 304
Dunmore Lake 32
Dunn, George H 384
Dry-salting, Food Products preserved by 343
Dynamiting Fish in Hawaiian Islands 412
Edenton Station 14, 24
Report 50
edentulus, Strophites 175
Edwards, Vinal N 128, 241, 248
Eel 237, 287
Cat 286
Pot 328
Reproduction of 128, 129
Eigenmann, C. H 127, 128
Electrical Storm, Effect on Fish Eggs 51
Ellice Islands, Fishing Methods, Apparatus, and Boats 794–796
Ellis, J. F 304
Elmore Atoll 811
elongatus, Cycleptus 286
Leuciscus 211
Emerson, J. S 355, 383, 405
Erimyzon sucetta oblongus 210, 236
Erwin Station Report 52
erythrogaster, Chrosomus 210, 236
Esox lucius 238
masquinongy 224, 239
reticulatus 224, 238
Etheostoma boreale 240
cœruleum 174, 215
flabellare 174, 215, 240
Eua Island 782
Eucalia inconstans 214, 224, 239
Eupeneus porphyreus 371
trifasciatus 371
Eupomotis gibbosus 115, 174, 214, 224, 239
European Biological Stations 135–139
Evermann, B. W 18, 113, 124, 241
Evermann, B. W., on Fishes of Lake Ontario 209–216
Evermann, B. W., on Fishes and Fisheries of the Hawaiian Islands 353–380
Evermann, B. W., on Fishes and Mollusks of Lake Chautauqua 169–175

Page.
Evermann, B. W., on Fishes of Lake Champlain and Tributary Waters ... 217–225
Evermann, B. W., on Fishes of St. Lawrence River ... 227–240
Evermann, B. W., on New Species of Shad ... 275–283
Evermann, T. B ... 113
Exoglossum maxillingua ... 212, 223, 237
Experiments in Tagging Cod ... 193–208
Exports of Fishery Products from Hawaiian Islands ... 451
Expositions ... 15
Exposition, Pan-American ... 289–351
Eyster, J. A. E ... 130
Fakarava Island ... 752
Fall-fish ... 211, 236
Fan-tailed Darter ... 215, 240
Fassett, H. C ... 743
Fathead Minnow ... 211
Fattening Oysters for Market ... 10
Ferguson Hatching-jar ... 317
Fertilizer made from Fish Waste ... 300
Field, George W ... 127
Fiji Islands, Fishing Methods, Apparatus, and Boats ... 787–793
Filtration for preventing Fungus on Fishes in Captivity ... 299
Findon Haddocks ... 269
Finnan Haddies ... 269
Fish and Fish Eggs, Distribution of ... 3–8
  Bait in Hawaiian Islands ... 423–425
  Baskets in Hawaiian Islands ... 408
  Diseases ... 10, 54, 58, 63, 68, 73, 79, 124, 298
  Exhibit at Pan-American Exposition ... 323
  Food ... 298
  Fry, Apparatus for transporting ... 315
  Hatching at Pan-American Exposition ... 293
  Hooks ... 338
    used in Hawaiian Islands ... 416–421
  Legislation of Michigan ... 585
  Markets of Hawaiian Islands ... 373, 434
  Ponds of Hawaiian Islands ... 374, 427–433
  Skins used in Leather Goods ... 300
  Trade of Hawaiian Islands ... 432
  Traps in Hawaiian Islands ... 411
  Weirs in Hawaiian Islands ... 413
Fish Commission Publications available for Distribution ... 177–192
Fish Hawk Model ... 306
  Operations of ... 13, 42
Fish Lakes Station ... 45
Fish-cultural Exhibit at Pan-American Exposition ... 315–322
  Results ... 25
  Operations for 1901 ... 1
Fish Eggs, Adhesion of ... 56
Fisheries and Aquiculture, International Congress of ... 133–135
  of Hawaiian Islands ... 10, 123
  California ... 549–574
  Lake Erie ... 630–644
    Huron ... 616–627
    Michigan ... 597–616

Page.
Fisheries of Lake Superior ... 584–596
  Ontario ... 645–649
  Mississippi River ... 157–160
  Oregon ... 535–549
  Pacific Coast ... 163–501–574
  Washington ... 512–534
  Statistics and Methods of ... 141–166
Fishermen, Hawaiian, Religious Beliefs and Superstitions ... 389–393
  of Hawaiian Islands ... 387
Fishery Exhibit at Pan-American Exposition ... 294
  Laws of Hawaii ... 359–370
  Legislation ... 714, 725
  Products, Exhibit at Pan-American Exposition ... 343–351
    exported from Hawaiian Islands ... 451
    imported into Hawaiian Islands ... 443–450
    in Hawaiian Islands ... 376
    of Hawaiian Islands, Preparation of ... 433
  Rights of Hawaiian Islands ... 455
  Statistics of Hawaiian Islands ... 461–465
Fishes and Fisheries of the Hawaiian Islands ... 353–499
  Mollusks of Lake Chautauqua ... 169–175
  introduced into Hawaiian Islands ... 451
  of Lake Champlain and Tributary Waters ... 217–225
  St. Lawrence River ... 227–240
Fishing Apparatus proposed for Hawaii ... 423
  Gazette ... 304
  Grounds and Food-fishes ... 11–140
  Leads and Sinkers ... 338
  Lines ... 329
  Machine of Niagara River ... 650
  Methods of South Sea Islands ... 741–829
  Scenes on New England Coast ... 323
  through Ice ... 718
  with the Hands in Hawaiian Islands ... 415
Fishway ... 320
flabellare, Etheostoma ... 174, 215, 240
Flat-fish ... 37
  Distribution of ... 110
  Propagation of ... 2, 23
flavescens, Perca ... 174, 215, 225, 239
flavus, Noturus ... 210
Florida Fisheries ... 12
  Sponge Fishery ... 156
  Sturgeon Fishery ... 155
Fongafale Village ... 794
fontinalis, Salvelinus ... 172, 224, 238
Food-fishes and the Fishing-grounds ... 111–140
  Propagation of ... 1
  of Hawaiian Islands, List of ... 357–359
Food for Fish in Captivity ... 298
  Silversides ... 247–255
  Young Fish ... 21, 48, 49, 52, 54, 68, 78, 79, 81
Formalin used to prevent Fungus on Fishes in Captivity ... 299

Page.

Free Transportation by Railroads 9
Fresh Salmon, Exportation of 537
Wide Distribution of 509
Fresh-water Drum 216, 225, 287
Fishes at Pan-American Exposition 296
in Aquarium 47
Mussels 350, 707, 714, 722, 725
Frog Fishery of Illinois 677
Minnesota 726
Frogs in Hawaiian Islands 373, 452
Frost-fish 223
Fry, Methods of Planting 61
Fryer, Charles E 139
Funafuti Atoll 794
Fundulus diaphanus 112, 213, 239
furcatus, Ictalurus 286
Fur-seal Fisheries 12
Rookeries of Pribilof Islands 165
Skins 301
Furs, Exhibit at Pan-American Exposition 347
Fusiform Darter 215
fusiformis, Bolcichthys 215
Fyke Nets 327
Gadus callarias 524
Gardon 236
Gar Pike 171, 222, 235
Laws for Destruction of 171
Gasperot 237
Gasterosteus atkinsii 112
bispinosus 214
Gay, Francis 384
gibbosus, Eupomotis 115, 174, 214, 224, 239
Unio 175
Gilbert Islands, Fishing Methods, Apparatus and Boats 797, 802
Gill Nets 309, 327, 328
in Lake Huron 618
Preservation of 589
used in Hawaiian Islands 397
Gillum, Robert G 113
Gizzard Shad 287
Glaser, O. C 130
Glasgow, W. T 76
Gloucester Fisheries 11, 144–146
Station 35
Glue made from Fish Skins 200
Glues, Exhibit at Pan-American Exposition 349
Goggle-eye 174
Golden Gate, Steamer 325
Golden Ide 45
Gold-fish 45
introduced into Hawaiian Islands 452
Goldsborough, E. L 124, 355
Goldsborough, E. L., on Fishes and Mollusks of Lake Chautauqua 169–175
Goldsmith, Z. H 45
Goujon 296
Gould, Thomas B 121
Gourdeau, F 304
Gourd-seed Sucker 286
gracilis, Menidia 259, 261
Menidia beryllina 259

Page.

gracilis Uranidea 225, 240
Graham, John Y 130
Grampus, Model of 323
grandis, Anodonta footiana 175
Grass Pike 213, 238
Grave, Caswell 127, 130
Grayback 213
Grayling 63, 73, 80
Distribution of 100
Great Lakes, Biological Survey of 113
Catfish 222
Fisheries 12, 152–154, 575–657
Fish-cultural Operations in 1
Green Bay Fish Trade 616
Green, C. K 45
Green, Erik H 127
Green, H. A 127, 128
Green Lake Station Report 28
Green-sided Darter 215
Greensword, D. J 587
Grinnel Cat 677
grunniens, Aplodinotus 216, 225, 287
Guam Island, Fishing Methods, Apparatus and Boats 828
Guillou, M 138, 139
Gulf of Mexico Biological Laboratory 11, 132
Gurley, R. R 209
guttatus, Percopsis 214, 224, 239
gyrinus, Schilbeodes 210
Haddocks, Scotch Methods of Smoking 269–271
Hadropterus aspro 215
Hahn, E. E 193, 304
Half Cast Village 791
Halibut 528
Hall, Ansley 576, 660
Hamaker, J. I 130, 132
Handy, H. B 26
Harbor Seals at Pan-American Exposition 297
harengus, Clupea 237, 269
Hargitt, Charles W 127
Harraseekett River 112
Harron, L. G 44, 46, 305
Hatchery Model 316
Hatching Apparatus 317–319
Barge, Model of 317
Hawaii 384
Hawaiian Fisheries 466–480
Fishery Laws 359–370
Fishes, List of 458–460
Fishing Boats 394–396
Apparatus 396–421
Fish Ponds 427 433
Islands, Commercial Fisheries of 378–499
Fishery Regulations suggested 372
Fishes and Fisheries of 353–499
History of 386
Introduction of Additional Fishes 373
Investigation of Fisheries of 10, 122
Whale Fishery 481–496
Hawksbill Turtle 350

Page.

Hay, W. P 120
Heart Trap or Weir 327
Heath, Harold 127
Henshall, J. A 18, 73
Hereheretue Island 768
Hering, J. M 355, 384
Herrick, C. Judson 127, 247
Herring Seine 327
Trade in Europe 139
Hervey Group 778
Hessel, Rudolph 45
heterodon, Notropis 211
Hickory Shad 287
Hikueru 760
Hill, W. F 113
Hilo Fish Market 376, 440
Hinkley, R. H 209
Hiodon alosoides 287
tergisus 223, 237
Hippoglossus hippoglossus 528
Hog Sucker 171
Holbrook, Charles H 127
Holmes, J. A 14
Holmes, S. J 127, 128
Honolulu Fish Market 376, 436
Horned Dace 223
Hornpout 222, 235
Howe, Freeland 127
Hruby, Charles 64
Huaheine Island 776
Hubbard, W. F 34
Hudson, C. B 18, 124, 355
hudsonius, Notropis 172, 173, 212, 223, 236
Human Flesh used as Fish Bait 422
Hume, R. E 80
Huitouche 236
Hurepiti Bay 776
Hurlbut, H. F 63
Hybognathus nuchale 211
Hybopsis kentuckiensis 212
storerianus 212
Hypomesus pretiosus 548
Ice-fish 224
Ichthyomyzon concolor 222, 235
ictalops, Cottus 174, 216, 240
Ictalurus anguilla 286
furcatus 286
punctatus 209, 286
Ictiobus bubalus 286
Illinois Fisheries 652, 653
Statistics of 604, 610, 676–684
Imports of Fishery Products into Hawaiian Islands 443–450
inconstans, Eucalia 214, 224, 239
Indiana Fisheries 652, 653
Statistics of 604, 610, 673–676
Ingersoll, Ernest 127
Ingram, James 139
International Congress of Aquiculture and Fisheries 133–135
Invertebrate Exhibit at Pan-American Exposition 323
Iowa Fisheries, Statistics of 714–722
Irish Drop Net 326
Isinglass Exhibit at Pan-American Exposition 349

Page.

Isinglass made from Fish Sounds 300
Ivory Exhibit at Pan-American Exposition 350
Jaluit Island 803
Jars for Fish-hatching 55
Jenkins, O. P 124, 355
Johnny Darter 240
Johnson, J. M 127
Johnson, R. S 62
Jones, Alexander 52
Jones, J. E 303
Jordan, D. S 18, 124
on Fishes and Fisheries of Hawaiian Islands 353–380
Kahoolawe 385, 469
Kambara Island 787
Kansas Fisheries, Statistics of 738–740
Kauai 385, 470
Kellogg, James L 121, 127, 128
Kendall, F. P 78
Kendall, William C 18, 111, 121, 133
Kendall, W. C., on Fishes of Lake Champlain and Tributary Waters 217–225
Kendall, W. C., on Fishes of Lake Ontario 209–216
Kendall, W. C., on Fishes of St. Lawrence River 227–240
Kendall, W. C., on Silversides of the Genus Menidia 241–267
kentuckiensis, Hybopsis 212
Kentucky Fisheries, Statistics of 685–688
Key West Smackee 325
King Salmon 506
King, E. S 141, 576, 660
Kirsch, P. H 18
Kirtlandia 242
Kiti Harbor 823
Knowlton, Millard 113
Knox Island 800
Koebele, Albert 383
Kusaie Island 818
Labidesthes sicculus 174, 214
labradoricus, Coregonus 224, 237
Labrador White-fish 237
lacustris, Ameiurus 222, 235
Lahaina Fish Market 441
Lake Carp Sucker 235
Lake Dunmore 32
Lake Erie Fisheries 630–644
Pound 327
Lake Herring 213, 237
Distribution of 102
Propagation of 22, 56
Lake Huron Fisheries 616–627
Lake Michigan Fisheries 597–616
Lake Mitchell 32
Lake of the Woods Fisheries 151
Lake Ontario Fisheries 645–649
Notes on Fishes of 209–216
Lake Sturgeon 209, 222, 235, 285
Lake Superior Fisheries 584–596
Lake Trout 22, 26, 70, 213, 224, 238
Distribution of 99
Eggs, Collection of 1
Hatching 57, 60, 61, 80
Lambson, G. H 21, 74, 77

Page.

Lamon, E. W. 304
Lampsilis luteolus 175
Lanai 385, 471
Landlocked Salmon 30
Distribution of 86
Lankester, E. Ray 136
Large-mouth Black Bass 45, 47, 174, 214, 224, 239
Laurentian Club 32
Laws for Fishing in Chautauqua Lake 170
Leadville Station Report 69
Leary, J. L 67
Leathers from Water Animals, Exhibit at Pan-American Exposition 349
Legislation, Fishery 245
Lepisosteus osseus 171, 209, 222, 235
platostomus 171
Lepomis pallidus 174, 214
Leptops olivaris 286
Leuciscus elongatus 211
margarita 211
Lewis, Albert D 127
Likieb Atoll 312
limi, Umbra 213, 224, 238
Limnæa palustris 175
lineatus, Roccus 240
Line Fishing in Hawaiian Islands 415
Ling 216, 225, 240
Linton, Edwin 18, 127, 128
Listoe, S 139
Little White Salmon Station Report 81
Lo Bianco, Dr 137
Lobster, Distribution of 110
Eggs, Collection of 36, 37
Fisheries of Foreign Countries 140
Pot 326
Pounds 138
Propagation of 23
Rearing 10, 121
Loch Leven Trout, Distribution of 88
Hatching 59, 63, 70, 71
Locke, E. F 36, 304
Logging detrimental to Fish Life 121
Log Perch 215, 225, 240
Loli Fishery of Hawaiian Islands 498
Longe 224
Long-jaw White-fish 213
Long-nosed Dace 223, 236
Sucker 171, 210, 222, 235
Lota maculosa 216, 225, 240
Louisiana Fisheries, Statistics of 697–701
Loup River 735
lucius, Esox 238
Lucius lucius 213
ohiensis 172
reticulatus 213
vermiculatus 213
Lump-fish 240
lumpus, Cyclopterus 240
Lunatia 208
luteolus, Lampsilis 175
Lymphosporidium truttæ 125
Mackerel 239
Fisheries 11, 149
Macropternotus maqur 373, 452
maculosa, Lota 216, 225, 240
Mad Tom 171, 210

Page.

Magruder, William T 114
Maiana Island 800
Makatea Island 749
Makemo 756
Mammalian Exhibit at Pan-American Exposition 323
Man, E. A 139
Mancha, H. H 57, 60
Manchester Station Report 62
Maraki Island 801
margarita, Leuciscus 211
Marine Biological Laboratories 10
Marks, H. H 26
Marquesas Islands, Fishing Methods, Apparatus, and Boats 743–746
Marsh, M. C 58, 64, 119, 124, 133, 241, 304
Mason, R. C 26
Marshall Islands, Fishing Methods, Apparatus, and Boats 803–817
marstoni, Salvelinus 238
Martin Novelty Company 303
Martin, S. J 142
Mason, M. A 38
masquinongy, Esox 224, 239
Mast, S. O 115
Matagamon Lake 111
Mat Island 813
Maui 385, 472
maxillingua, Exoglossum 212, 223, 237
Maxinkuckee Lake 112
Mayer, A. G 743
McClure, C. W. F 127
McDonald Egg-transportation Crate 315
Hatching-jar 318
Universal Hatching-jar 318
White-fish Jar 318
Y-shaped Hatching-Box 317
McMurray, J. H 127
Mead, A. D 37, 121
Measure for counting White-fish Eggs 319
Meek, Seth E 18
Megler, J. G 78
Melander, Axel L 127
Melanogrammus aeglifinus 269
melas, Ameiurus 171, 210
Menhaden 112
menidia, Atherina 264
Atherinichthys 264
Menidia 242
audens 259
beryllina 241, 259, 261
cerea 261
brasiliensis 264
dentex 264
gracilis 259, 261
beryllina 259
peninsulæ 257
atrimentis 258
menidia 262, 264
notata 264
notata 262, 264
Notes on the Genus 241–267
Menominee White-fish 223
Methy 225
Michigan Fisheries 637, 652, 653, 654–655
Statistics of 593–594, 604–609

Page.

Michigan Fish and Game Warden 58
Legislation 585
Microgadus tomcod 240
Micropterus dolomieu 174, 214, 224, 239
salmoides 174, 214, 224, 239, 373
Miller's Thumb 174
Minnesota Fisheries 652, 653
Statistics of 595, 725–730
State Fish Commission 303
Mississippi Fisheries, Statistics of 694–697
River and tributaries, Statistics of the Fisheries 659–740
River Fisheries 12, 157, 160
Sucker 286
Missouri Fisheries, Statistics of 707–713
miurus, Schilbeodes 171, 210
Moen Island 825
Moenkhaus, W. J 127
Observations on Eggs of the Silverside 247
Mohican Island 747
Molluscan Exhibit at Pan-American Exposition 309
Mollusks of Chautauqua Lake 175
Molokai 385, 475
Molokini 386
Moloney, J. Storan 355, 384
Mooneye 223, 237
Moore, G. H. H 441, 660
Moore, H. F 122, 133, 304
Moore, J. P 115
Moorea Island 776
mordax, Osmerus 224, 238
Morgan, T. H 130
Morgan, W. E 304
Mottled Mad Tom 210
Motu-uta Island 769
Moxostoma anisurum 210, 236
aureolum 172, 210, 222, 236, 287
Mud Eel 217
Fish 222, 235
Minnow 224
Mugil cephalus 112
dobula 371
Mullet 222
Mullus barbatus 372
Muskallunge 224, 239
of Chautauqua Lake 170
Mussel Exhibit at Pan-American Exposition 350, 351
Shell Industry 678
Shells used for making Buttons 300
Value of 12
Mutoscope, Exhibit of 302
mykiss, Salmo 72
Myriophyllum 169
namaycush, Cristivomer 213, 224, 238
Namo Island 825
Namu Atoll 811
Namuka Island 785
Naphtha Engines used in Fishing 589
Naples Zoological Station 136
Nashua Station 14
Report 34
Nebraska Fisheries, Statistics of 734–737
nebulosus, Ameiurus 115, 171, 210, 222, 235, 286

Page.

Neiafu Harbor 785
Neosho Station 27
Report 65
Nevada, Commercial Fishing in 162
New England Dory 326
Fishing Schooners 324
Grand Banks Schooner 324
New Orleans Fishing Lugger 325
New York Fisheries 638, 652, 653, 657
New Zealand, Salmon Eggs shipped to 21, 76
Niagara River Fisheries 650
Niau Island 750
Nickerson, A. R 36
nigricans, Catostomus 171
nigrum, Boleosoma 215
olmstedi, Boleosoma 225, 240
Niihau 386, 475
Niue Island 780
Northern Darter 240
Northville Station Report 57
notata, Atherina 264
Atherinichthys 264
Menidia 262, 264
notatus, Pimephales 172, 211, 223, 236
Notropis atherinoides 212, 223, 236
blennius 211, 223, 236
cayuga 172, 211
cornutus 172, 173, 212, 223, 236
heterodon 211
hudsonius 172, 173, 212, 223, 236
muskoka 112
rubrifrons 212, 223, 236
whipplii 172, 212, 223, 236
Noturus flavus 210
nuchale, Hybognathus 211
Nukualofa 782
Nukuhiva Islands 743
Nukutavake 765
Nutman, James R 139
Oahu 386, 477
Octopus 140
Odia Atoll 811
ohiensis, Alosa 277, 279, 664
Lucius 172
Ohio Fisheries 639–641, 652, 653
Statistics of 672
River Fishes 275–288
Shad 279, 664
Sturgeon 285
Oil, Food Products canned in 345
Oils and Fats, Exhibit at Pan-American Exposition 347, 348
Oldenburg, G. H 78
olivaris, Leptops 286
Olmsted's Darter 215
Oncorhynchus nerka 506
tschawytscha 506
ontariensis, Thymallus 213
Ontario Lake, Fishes of 209–216
Ophiodon elongatus 525
oquassa, Salvelinus 111
Ordway, T 127
Oregon Fish and Game Association 80
Fisheries 12, 535–549
Osmerus mordax 224, 238
osseus, Lepisosteus 171, 209, 222, 235

Page.

ouananiche, Salmo 238
Oyster Beds of California 564
Culture 131
Dredge 333
Exhibit at Pan-American Exposition 310–312
Fattening Experiments 10, 121
Scrape 333
Tongs 333
Oysters in Hawaiian Islands 374, 453
Pacific American Fishery Company 524
Coast Fisheries 163, 501–574
Herring 534
Paddle-fish 171, 284, 663
Caviar from 160
Page's Egg Scale 319
Page, Howard 302
pallidus, Lepomis 174, 214
palustris, Limnæa 175
Pan-American Exposition 15, 133, 289–351
Papeete 755, 769
Paralichthys californicus 570
stellatus 257
Paris Exposition 17, 18
Parker, George H 127
Parker, W. H 32
Paumotu Islands, Fishing Methods, Apparatus and Boats 746–769
Pearl-bearing Mussels 350
Pearl-button Industry 670, 714, 722
Pearl Fishery of Hawaiian Islands 498
Hikueru 761
Pearl, Raymond 116, 127
Pearls and Nacre. Exhibit at Pan-American Exposition 350
Pearly Minnow 211
peninsulæ atrimentis, Menidia 258
Chirostoma 257
Menidia 257
Penning White-fish 55
Pennsylvania Fisheries 637, 652, 653
Perca flavescens 174, 215, 239
Perch 174
Percina caprodes 174, 215, 225, 240
zebra 215
Percopsis guttatus 214, 224, 239
Peridinium 129, 130
Perkins, Henry F 127
Perrier, Edmond 133
Physa ancellaria 175
Pickerel, Distribution of 103
Pickled Food Products 344, 345
Pike 224
Pike Perch 112
Distribution of 101
Fry, Demand for 2
Hatching 22, 39, 56
Pile-drivers used in Fisheries of Pacific Coast 523
Pimephales notatus 172, 211, 223, 236
promelas 211
Pinaki Island 767
Pingelap Island 823
Pivers Island 15
Plankton 114
Planorbis bicarinatus 175

Page.

Planorbis campanulatus 175
trivolvis 175
Planting Fry, Methods of 61
platorhynchus, Scaphirhynchus 285
platostomus, Lepisosteus 171
Plecoglossus altivelis 374
plumbeus, Couesius 223, 237
Plunging Bucket 317
Plymouth Biological Laboratory 136
Poisoning Fish in Hawaiian Islands 413
Poisson Armé 235
Polyodon spathula 171, 284
Pomolobus chrysochloris 281
pseudoharengus 213, 237
Pomoxis sparoides 214, 239
Ponapi Island 823
Pond Perch 224
Pond, R. H 115
Portland Fresh-fish Business 545
Port Lottin 818
Potamogeton 169
Potassium permanganate used to prevent Fungus on Fishes in Captivity 298
Pound-net Boat 326
Pound Nets in Lake Huron 618
Pratt, J. B 355, 383
Presumpscot River 112
Pribilof Fur-seal Rookeries 165
Private Fishery Rights in Hawaiian Islands 455
prognathus, Argyrosomus 213
promelas, Pimephales 211
Propagation of Food-fishes 21–110
pseudoharengus, Pomolobus 237
Pseudopleuronectes americanus 240
Publications issued in 1901 19
of Fish Commission available for Distribution 177–192
Pumpkin Seed 174, 214
punctatus, Ictalurus 209, 286
Purse Seine 326
Put-in Bay Station Report 55
quadrilateralis, Coregonus 223, 237
Quahog Rake 333
Quillback 287
Quincy Station Report 62
Quinnat Salmon 506
Distribution of 86
Hatching of 21
Race, E. E 28
Rahiroa Island 746
Raiatea Island 776
Railroad Transportation 9
Rainbow Darter 174, 215
Trout 3, 8, 25, 49, 53, 587
Distribution of 88
Hatching 59, 63, 70, 72
Ralick Chain 812
Rana catesbiana 373
Rand, Herbert W 127
Rangeley Lakes 111
Raroia Atoll 756
Ratack Chain 812
Ravenel, W. de C 15
Ravenel, W. de C., Report on Pan-American Exposition 289–351

Page.

Ravenel, W. de C., Report on Propagation and Distribution of Food-fishes 21–110
Red-bellied Dace 210, 236
Red-eye 174
Redfin 172, 212, 223, 236
Red-fronted Minnow 212
Redhorse 210, 222, 236
Red-nosed Minnow 236
Red-sided Minnow 211
Red Salmon 506
Trout 32
Reighard, Jacob 113
Reptilian Exhibit at Pan-American Exposition 323
reticulatus, Esox 224, 238
Lucius 213
Rhinichthys atronasus 172, 212, 223, 236
cataractæ 223, 236
rhomboideum, Sphærium 175
Richardson, Roy Spencer 127
River and Lake Fisheries of Maine 111
River Seine 326
Rivers of Hawaiian Islands 373
Roach 211, 223
Roberts, W. A 141, 576, 660
Robertson, W. F 139
Robinson, David 128
Robinson, William T 355, 384
Roccus chrysops 216
lineatus 240, 504
Rock Bass 49, 64, 174, 214, 224, 239
Distribution of 108
Hatching 66, 67
Chub 236
Pike 225
Rogers, J. B 51
Rogue River Station Report 80
Rongelab Atoll 811
Rongelappelap Island 811
Roosevelt, Theodore, Letter of Transmittal from 354
Root, Henry T 37
Rose Bream 236
Rose Floating Trap 327
Rosy-front Minnow 223
Rotoava 752
Round White-fish 223, 237
Rowell, P. H 25
Royal, Steam schooner 326
rubicundus, Acipenser 209, 222, 235, 285
rubrifrons, Notropis 212, 223, 236
rupestris, Ambloplites 174, 214, 224, 239
Rurick Pass 816
Rustin, Henry 303
Rutter, Cloudsley 116
Ryder, John A., Observations on Eggs of Silversides 246
Saint Bernard Club 31
salar, Salmo 213, 224, 237
Salinometers 307
Salmo gairdneri 587
irideus 587
mykiss 72
ouananiche 238
salar 213, 224, 237
sebago 111, 224

Page.

salmoides, Micropterus 174, 214, 224, 239
Salmon 224, 237, 287
Canned in 1899 164
Destroyed by Copper Refuse 117–119
Fisheries of Pacific Coast 505–509
Fry, Planting of 79
Hatching 1, 75, 78, 81, 82
in Hawaiian Islands 452
Spawning Box or Jacket 320
Statistics of Pacific Coast 507–511
Tackle 352
Salt used to prevent Fungus on Fishes in Captivity 298
Salt-water Fishes at Pan-American Exposition 296
Aquarium 47
Salvelinus fontinalis 172, 224, 238, 373
marstoni 238
oquassa 111
Sampan 395
Sand Pike 174
San Francisco Fisheries 563
San Luis d'Apara 828
San Marcos Station 27
Report 67
sapidissima, Alosa 213, 237, 277, 281
Sardine Industry of France 11
Trade in Europe 139
Sargent, Porter Edward 127
Satin-fin Minnow 212
Sauerhoff, W. P 304
Sauger 215, 225, 239
Savage Island 780
Scaff Net 319
Scaled Ling 222
Scallop Dredge 333
Scaphirhynchus platorhynchus 285
Schilbeodes gyrinus 210
miurus 171, 210
Schneider, George A 304
Scirpus 169
Scomber colias 569
scombrus 239
Scoop Nets used in Hawaiian Islands 406
Scotch Methods of Smoking Haddocks 269–271
Sea Trout 31
Distribution of 100
Scovell, J. T 113
Scrape Nets 309
Scudder, C. W 304
Seagle, George A 47
Seagle Egg-transportation Box 315
Hatching-trough 319
Sea Horse 333
Seale, A 355
Seal Fishery of Hawaiian Islands 496
Sea Lions 569
on Pacific Coast 549
Sea Otter 301
Fishery of Hawaiian Islands 497
Seaweed Fishery 140
sebago, Salmo 111, 224
Sebastichthys rosaceus 572
serriceps 573
Sebec Lake 111
Seines used in Hawaiian Islands 396

Page.

Semotilus atromaculatus 112, 172, 173, 211, 223, 236
corporalis 211, 223, 236
Shad 224, 237
Distribution of 85
Hatching 2, 42, 43, 44, 50
in Pennsylvania 150
New species of 275–283
on West Coast 504, 537
Propagation 24
Shad-waiter 224
Shark Fishing in Hawaiian Islands 421, 498
Shawenegan Club 32
Shayne, C. C 17, 303
Sheepshead 216, 225
Sherwood, George H 121, 127, 128
Shiner 172, 236
Shore Fisheries of Lake Erie 637–642
Huron 623–626
Michigan 606–614
Superior 593–596
Short-nosed Gar 171
Sturgeon 253
Shovelnose Sturgeon 285
Shrimp Fisheries of California 550
sicculus, Labidesthes 174, 214
Signalosa atchafalayæ 275
Silver Chub 223
Silver-fin 172, 223
Silver Salmon 22, 81
Distribution of 88
Silverside Minnow 223
Silversides of the Genus Menidia 241–257
Silvery Lamprey 222, 235
Minnow 211
Silvester, C. F 127
Silvester, G. W. P 127
Sindo, M 355, 384
Skipjack 174, 214
Slender Minnow 212, 236
Small, R. C 207, 208
Small-mouthed Buffalo 286
Black Bass 174, 214, 224, 239
in Hawaii 374
Smelt 224, 238
of Pacific Coast 548
Smith, Carl S 355, 384
Smith, F. G 355
Smith, Hugh M 18, 133, 134, 241, 304
Smith, Hugh M., on Inquiry respecting Food-fishes and the Fishing-grounds. 111–140
Smith, Hugh M., on Scotch Methods of Smoking Haddocks 269–271
Smith, Hugh M., on Tagging Cod at Woods Hole 193–208
Smith, James A 42
Smoking, Food Products preserved by 344
Snap Net 326
Snapping Turtle 677
Snaring Fish in Hawaiian Islands 414
Snow, Julia W 115
Society Islands, Fishing Apparatus, Methods, and Boats 769–778
Soldier-fish 174
South Dakota Fisheries, Statistics of 730–733

Page.

South Sea Islands, Notes on the Boats, Apparatus, and Fishing Methods of 741–829
sparoides, Pomoxis 214, 239
spathula, Polyodon 171, 284
Spawn-takers, Instructions to 57
Spearfish Station Report 71
Spearing Fish in Hawaiian Islands 411
Sphærium rhomboideum 175
striatinum 175
sulcatum 175
Spiny Lobster Catch of California 574
Split-lip Minnow 212
Sponge Exhibit at Pan-American Exposition 312–314, 351
Fishery 12
Appliances 333
Experiments 10, 122
of Florida 156
Spoonbill Cat 160, 171, 284
Spot-tail Minnow 212, 223
Stackable, E. R 355, 383
Starry Flounder 527
Statistics and Methods of Fisheries 11, 141–166, 323–342
Statistics of Fisheries of Alabama 693
Arkansas 701–707
Great Lakes 575–657
Illinois 676–684
Indiana 673–676
Iowa 714–722
Kansas 738–740
Kentucky 685–688
Lake Erie 632–644
Lake Michigan 598–614
Lake Ontario 646–649
Lake Superior 590–596
Louisiana 697–701
Minnesota 725–730
Mississippi 694–696
Mississippi River and Tributaries 659–740
Missouri 707–713
Nebraska 733–737
Ohio 672
South Dakota 730–733
Tennessee 689–692
West Virginia 671
Wisconsin 722–725
Salmon Fishery of Pacific Coast 507–511
Steelhead Trout 22, 70, 587
Distribution of 88
Hatching 61–74
in Lake Superior 26
Stanley, H. O 111
Stations, Inspection of 27
Station Reports 28–84
St. Clair Lake Fisheries 627–629
River Fisheries 627–629
St. Johnsbury Station Report 31
St. Lawrence River Fisheries 650
Fishes of 227–240
Stejneger, Leonhard 18
Stevenson, C. H 18, 141, 576, 660

Page.

Stone Cat 171
Pike 174
Roller 172, 210
Stone, Charles W 127
Stone, Livingston 38
storerianus, Hybopsis 212
Storer's Minnow 212
Stickney, M. W 127
Stickney, M. E 127
Stizostedion canadense 215, 225, 239
vitreum 215, 225, 239, 287
Stranahan, J. J 54, 55
Straw Bass 174
Strawberry Bass, Distribution of 109
Hatching 65, 67
Straw-colored Minnow 211, 223
striatinum, Sphærium 175
Striped Bass 174, 240
in California 504
Strong, R. M 127
Strophites edentulus 175
undulatus 175
Sturgeon at Pan-American Exposition 297
Sturgeon, Distribution of 120
Fishery of Florida 155
Hatching 39–42, 59
Propagation of 23
Set Line 329
sturio, Acipenser 235
sucetta oblongus, Erimyzon 210, 236
sulcatum, Sphaerium 175
Summary of Distribution 9
Sumner, Francis B 127
Sun-fish 174
Distribution of 109
Surf Smelt 548
Suva Harbor 790
Suvavu Village 791
Swamp Muck 56
Swivels 338
Sword-fish Fishing 337
Tackle for Bait Fishing 330
Fly Fishing 331
Sea Fishing 329
Trolling 330
Tagging Cod at Woods Hole 193–208
Salmon 116
Tahaa Island 776
Tahiti Island 769
Tai-o-hae 743
Tangle Bars 308
Tanner Sounding Machine 307
Tanner, Z. L 18
Tarawa Island 800
Tari-Tari Island 801
Tarrentine, J. W 130
Tench 45
Tennent, D. H 130
Tennessee Fisheries, Statistics of 689–692
tergisus, Hiodon 223–237
Terranova Village 817
Terrapin from Illinois River 677
in Hawaiian Islands 453
Net 326
Tesselated Darter 225
Texas, Fishing in Interior Waters of 161

Page.

thompsoni, Carpiodes 222, 235
Triglopsis 216
Thompson, M. T 127
Thrum, Thomas G 383
Thymallus ontariensis 213
thymallus 213
Tiffany & Company 304
Tikei Island 752
Titcomb, John W 13, 18, 217, 303
Tolbert, G. H 73, 83
Tomcod 240
tomcod, Microgadus 240
Tonga Islands, Fishing Methods, Apparatus, and Boats 782–786
Tonga Tabu Island 782
Toothed Herring 287
Torching for Fish in Hawaiian Islands 414
Torrey, H. B 130, 132
Torrey, J. C 130
Tortoise-shell Exhibit at Pan-American Exposition 350
Touladi 238
Tower, R. W 127, 128
Tow Nets 308
Townsend, C. H 142, 165, 304, 743
Townsend, C. H., on Fisheries of the Mississippi River 659–740
Townsend, C. H., on Great Lakes Fisheries in 1899 575–657
Townsend, C. H., on Statistics and Methods of the Fisheries 141–166
Trachurops crumenophthalmus 371
Tree-fish 573
tricarinata, Valvata 175
Triglopsis thompsoni 216
Trout Trough 317
trivolvis, Planorbis 175
Trout 238
Development of, Pan-American Exposition 314
in Hawaiian Islands 452
Perch 214, 224, 239
Truk Group 825
truttæ, Lymphosporidium 125
Tulian, E. A 69, 141, 162, 505
Turtle Fishery 337
Tyzzer, Ernest E 127
Umbra limi 213, 224, 238
Underwood, W. H 303
undulatus, Strophites 175
Unio gibbosus 175
Unionidæ 175
Union Tank Line Company 302
Uranidea gracilis 225, 240
Valvata tricarinata 175
Vavau Island 785
Veeder, R. N 37
velifer, Carpiodes 287
vermiculatus, Lucius 213
Vermont State Fish Commission 303
Vessel Fisheries of Lake Erie 636
Huron 622
Michigan 604–606
Superior 593
Fishing of Hawaiian Islands 426
Whaling from Hawaiian Islands 481

Page.

Vinegar, Food Products pickled in 345
viridescens, Atherina 264
Viti Levu Island 790
vitreum, Stizostedion 215, 225, 239, 287
Vivipara contectoides 175
Von Bayer, H 45, 294, 304
Wailuku Fish Market 441
Waite, F. C 127
Walker, Bryant 115
Wall, W. E 383
Wall-eyed Pike 215, 225, 239, 287
Walter, Herbert E 127
Walton, Lee Barker 127, 128
Ward, H. B 114
Warmouth Bass 62
Distribution of 109
Warren, F. N 79
Washington, Fisheries of 12, 512–534
Waterhouse, Henry H 383
Watson, Frank E 127
Wells, J. E 121
Wells River Fish and Game Club 33
West Virginia Fisheries, Statistics of 671
Streams, Examination of 120
Whalebone Exhibit at Pan-American Exposition 350
Whale Fishery, Note on 166
of the Pacific Ocean 504
San Francisco 565
Whaling Apparatus Exhibit 334–337
Implements 301
Wheeler, W. M 127, 128
White-fish, Distribution of 101
Eggs, Collection of 22
Hatching 55, 60, 61, 80
Impounding of 1
White Bass 216
White-nosed Chub 172
Sucker 236
Perch 287
Salmon 287
Shad 223
Whitsunday Island 767

Page.

whipplii, Notropis 172, 212, 223, 236
Wholesale Fish Trade of Chicago and Green Bay 614
Lake Erie 642–644
Hawaiian Islands 442
Lake Huron 626
Lake Superior 596
Wilcox, W. A 18, 141
on the Fisheries of the Pacific Coast in 1899 501–574
Willard, William A 127
Williams, L. W 127
Williamson Hatching Trough with Stone Salmon Basket 317
Willoughby Lake 33
Willow Cat 286
Wilson, Charles B 127
Wilson, E. B 130, 132
Wilson, H. V 130
Wilson, John B 141, 576, 660
Winter Flounder 240
Wires, S. P 60
Wisconsin Fisheries 656
Statistics of 595, 605, 611–613, 722–725
Wise, W. S 355, 383
Wisner, J. N 43, 45, 81
Woods Hole Laboratory 10, 127
Station Report 36
Woodworth, W. McM 743
Woolman, A. J 18
Wotje Atoll 816
Wytheville Station Report 47
Yellow Bass 174
Cat 210
Perch 174, 215, 225, 239, 287
Distribution of 103
Yellowstone National Park, Investigation of Trout Streams 72
Yerkes, Robert M 127
Young, Leonard 113

O

LIBRARY
FISH & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS